FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

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Founder and Editor: STANLEY SPOONER

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DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

Aug. 22-27. Plymouth Air Week.
Aug. 25-Sept. 4. British Gliding Assoc. Competition, at Moorside, nr. Barrow-in-Furness.
Aug. 27. Llandrindod Wells Flying Meeting (Northamptonshire Ae. C.)
Aug. 27-Sept. 5. U.S. National Air Races, Cleveland, Ohio.
Aug. 28. Hull Ae. C. Visit to Nottingham Ae. C.
Aug. 28. Close of International Touring Competition, Berlin.
Sept. 1-4. Week-end Aérien, Starting at Heston.
Sept. 3. Manchester-Liverpool Inter-City Race.
Sept. 3. Leicester Chamber of Commerce Day, at Desford.
Sept. 3-4. Cinque Ports Flying Club Meeting.
Sept. 4. International Flying Meeting, Lympne.
Sept. 4. Divine Service at Ratcliffe Aerodrome, 2.30 p.m.
Sept. 5. F.A.I. Conference at The Hague.
Sept. 8. International Meeting, Vicenza, Italy.
Sept. 17. S. African Air Rally, Rand Aerodrome, Germiston.
Sept. 17-25. London Gliding Club Camp, Dunstable.
Sept. 18. Women Engineers' Flying Meeting at Stoneham Park, Southampton.
Sept. 24. Hillmans' Air Display at Maylands Aerodrome, Brentwood.
Sept. 24. No. 45 Sqdn. R.A.F. Reunion Dinner, at Overseas League Club House, Park Place, S.W.1.
Sept. 25. Ladies' At Home at Sywell.
Sept. 25. Gordon Bennett Balloon Race, Basle.
Oct. 1. Bristol and Wessex Ae.C. Garden Party.
Oct. 1-23. Berlin Sporting Flying Exhibition.
Oct. 8-9. Chatham Air Display.
Oct. 18. Aero Golfing Society: Celion Challenge Cup, West Hill G.C.
Nov. 18-Dec. 4. Paris Aero Show.

EDITORIAL COMMENT

PROBABLY it was a coincidence that the weather proved favourable for the start at practically the same time of two great air adventures, each of which has proved a triumphant success and has achieved its object. Professor Piccard started off in his balloon, accompanied by M. Cosyns, from Dubendorf aerodrome, near Zurich, to make further exploration of the cosmic rays in the stratosphere; while Mr. Mollison left Ireland in a "Puss Moth" to fly the Atlantic solo from East to West. Both have landed safely after enduring dangers and hardships. Mollison's self-imposed task is but half done, for he set before himself the double crossing of the Atlantic, a feat which has not yet been accomplished in any aeroplane, though it has become almost a commonplace of airship flights. Professor Piccard succeeded in rising higher from the earth than he did last year, and so accomplished a new altitude record. So far the two adventures are comparable, but then a contrast begins to force itself on our notice.

Two Great Air Feats

Piccard's balloon ascent was a scientific adventure. His spirit is the same as that of Admiral Byrd and Sir Hubert Wilkins, who took aeroplanes to the Antarctic not to be able to claim that they had flown over the South Pole, but in order to add to our knowledge of conditions in that continent. Wilkins, if we remember right, never has flown over either Pole. Though imbued with the love of exploration, he never sets out to break records for the sake of breaking them. His object is always scientific. Conditions in the Antarctic, he believes, govern the weather in the great producing countries of Australia, New Zealand, South Africa and South America, so he set out to investigate them. In the same way, Professor Piccard has made the exploration and study of the upper atmosphere, or stratosphere, peculiarly his own. He has twice ascended into it to make scientific study and records. What the value of these discoveries will ultimately prove to be we have at present no means of judging. We believe that every addition to the sum of human knowledge

is a good thing, an advance in some direction, though at the moment when the discovery is made it may not be possible to foresee the extent of the benefit which will ultimately be reaped. We know from experience that when facts are made available to the scientist, concrete advantages to the human race are often drawn from them in ways which could not have been foretold when the explorer set out. At the moment of writing, Professor Piccard himself probably does not know the extent of the new knowledge which has been recorded by his instruments. It may prove of the most profound importance. To get this knowledge, he has twice run very grave risks, and everyone will rejoice that he has twice returned to earth none the worse for his adventures. On this last occasion all seems to have gone as well as it could have done. The weather was perfect, the balloon rose without difficulty to about 10½ miles in three hours. It remained aloft for some 12 hours in all, and then descended near Lake Garda, in Italy, not so very far from the point of the start when one thinks of all that it had experienced in the meantime. All that was very well; but the two aeronauts had suffered terribly from the cold, which is said to have reached 64 deg. of frost. At the time the heat of a great anticyclone lay over Europe, and gasping terrestrians were in the mood to think that coolness at any price was the greatest boon to be desired. Professor Piccard, however, was afraid that he and his companion would be frozen to death. From that great cold they had to disembark on the plains of Italy in a shade temperature of 98 deg., and again they almost collapsed. No one can say that these two aeronauts did not suffer in the cause of science. The world owes them a debt of gratitude. Quite incidentally they established a new world's record for altitude.

The contrast of turning from a consideration of this great and worthy feat to thoughts of the latest Atlantic flight, is almost as great as the contrast in temperature experienced by Professor Piccard. We have often given our opinion about flying the Atlantic in a single-engined landplane, especially one without wireless, and no amount of admiration for the skill and gallantry of any particular pilot, or for the stout qualities of his machine and engine, can persuade us that such ocean flying is worth while or that it should be encouraged. Flying the Atlantic in the circumstances mentioned above can do no possible good. It does not point the way to establishing a commercial service. It does not prove anything which could not equally well be proved by flights where a safe landing was possible in case of engine failure. To fly a single-engined landplane across an ocean seems to us comparable to the case of trapeze acrobats who elect to perform without a net below them, so that a failure must probably mean death. Their skill could be displayed equally well with the net (or a reasonable landing ground) below them: and consequently the deliberate choice of danger is inexcusable.

At the same time, we believe that we can understand the desire of Mr. Mollison to be able to rank himself among the Atlantic fliers, and to exceed in some particulars what has been done by any of them in the past. These words are written before his start on the return journey, and so we can say nothing about his chances of being the first man to make the double crossing. He has flown the ocean from East to West, which is more difficult than the crossing in the other direction. Also he flew alone, and in a small "Puss Moth," two other facts which make the flight unique.

It is unfortunate, but it is a fact, that to be a successful Atlantic flier has come to confer a sort of status on pilots, of the sort suggested by the expression "blue riband." This state of affairs dates, not from the first crossing by Sir John Alcock and Sir Arthur Whitten-Brown, but from the crossing by Col. Charles Lindbergh. Quite apart from the general sympathy aroused by the recent tragedy in his family, Lindbergh is a man who is admired and liked wherever he goes. He has done fine work to advance the cause of flying in the United States. If he had never flown the Atlantic, he would be in all ways the most admirable of men and of pilots. But, unfortunately, he set the fashion for flying the Atlantic and now it seems that every pilot who has made a name for himself on other paths of the air, feels that he must qualify for the select company of Atlantic fliers. Even Hinkler, whom we used to consider the most level-headed of pilots, has succumbed to that lure; but perhaps there were special circumstances in his case which may almost excuse it. One of our chief reasons for admiring the career of Sir Alan Cobham is that he has never been tempted to make a flight which is both useless and needlessly dangerous. All his flights have been well worth while.

Mr. Mollison, however, is by nature a wonderful record-breaker. It is apparently his delight to match his very great skill in piloting and his unique power of enduring fatigue and lack of sleep against the great distances of the world. Even the great Sir Charles Kingsford Smith exclaimed that "Mollison had set a cruel pace" between Australia and England. Kingsford Smith is no carpet knight, but even he failed to equal Mollison's record. The England-Capetown record was the next to go down before Mollison's great driving powers; and then, like Alexander, he looked about for new worlds to conquer. A man like Mollison was hardly to be blamed if the wide stretch of the Atlantic should then draw him like a magnet. Mrs. Mollison was naturally not the woman to hold him back, for she too has known the call of adventure and has risked her life to do what no woman had done before. We must, in fact, recognise that the Atlantic was inevitable for Mollison, and that the man is not to be blamed for yielding to the temptation. We feel sure that he simply could not help it.

Of course, if his engine had failed when there was no ship in sight all who now are loudly singing his praises would have agreed with us that the life of a fine pilot is worth more than the Atlantic blue riband. We are profoundly thankful that that did not happen. There have, alas! been all too many good lives lost in that ocean from Nungessor and Minchin onwards. It is because we do not wish to see that tragic list grow any longer that we deprecate all Atlantic flying unless it is carried out with such precautions as spare engine power, wireless, spare pilot, etc., which reduce the risk to a minimum.

Leaving out the human element, no words of praise, however extravagant, would be too much to express respect for the machine, engine and accessories which, without a sign of distress from first to last have enabled Mollison to add this latest achievement to his credit.

THE START FROM PORTMARNOCK STRAND : In spite of its heavy load, the " Puss Moth " took off in 28 sec.

Mollison's Atlantic Flight

Ireland—New Brunswick in 30 Hours

ONCE more an East-to-West flight across the Atlantic has been successfully achieved, and this time by a British light aeroplane, the de Havilland " Puss Moth " fitted with de Havilland " Gipsy III " engine of 120 h.p. only. After awaiting favourable weather for several days in Ireland, Mr. J. A. Mollison flying solo took off from Portmarnock Strand at 11.35 a.m. on August 18, and headed west, with the other side of the "Herring Pond " as his immediate goal, and New York as his ultimate destination if the fates were kind. He did not reach New York as planned, but did cross the Atlantic, and ultimately alighted at Pennfield Ridge, New Brunswick, at 5.45 p.m., British Summer Time, after having been in the air for rather more than 30 hours. At the moment no definite information is available concerning the quantity of petrol left in the tanks when Mollison landed in New Brunswick, and thus it is not known for certain whether he could have carried on to New York as originally planned, had fatigue not beaten him and compelled him to land when he did. There appears to have been a rather unaccountable lapse of time between the sighting of Mollison over Halifax, Nova Scotia, and his landing in New Brunswick. Had the machine proceeded on its proper course during that time, it seems likely that New York could and would have been reached, as in that case both the petrol supply and the physical state of Mr. Mollison would probably have been equal to the task.

Mr. J. A. Mollison. (FLIGHT *Photo.*)

Mollison's original intention had been to attempt a double crossing of the Atlantic, flying direct to New York on the outward journey, and, after a day's rest and sleep, make the return flight as rapidly as possible, refuelling in Newfoundland if necessary. In spite of his undoubted grit and stamina, proved repeatedly on his now famous flights to Australia and South Africa, Mollison's physique did not prove sufficient, and he was compelled to land before reaching his objective. But he did realise his ambition to be the first to fly solo across the Atlantic from East to West, and although the return flight has not taken place as close to the outward flight as had at first been planned, we have no doubt that Mollison will make it, and indeed may be on his way when this week's issue of FLIGHT reaches our readers.

Of the flight itself there is but little to be said. After leaving the Irish coast, Mollison was sighted by two vessels and reported to be " going strong." The next news came from Halifax, Nova Scotia, over which the machine circled at 5.45 a.m., Eastern Standard Time (11.45 a.m. British Summer Time), on Friday, August 19. At first there was some slight uncertainty as to the actual identity of the machine seen, but it was not long before it was definitely ascertained that it was Mollison's " Puss Moth," carrying the registration letters G-ABXY, and named *The Heart's Content*. Mollison had crossed from Ireland to Nova Scotia in just over 24 hours, his average speed having been about 100 m.p.h.

When the machine left Halifax it was headed on its course for New York, but the next news of Mollison came not from there, but from St. John, New Brunswick (not to be confused with St. Johns, Newfoundland), and was to the effect that Mollison had landed at Pennfield Ridge, some 30 miles S.W. of St. John. The landing occurred at 5.45 p.m., British Summer Time, so that Mollison had taken some six hours to cover a little more than 100 miles. So far it has not been explained how this happened, but in his weary condition Mr. Mollison may well have lost his way and cruised about over the Bay of Fundy without knowing exactly where he was, especially as he is reported to have stated that the weather was cloudy and misty.

When Mollison abandoned the idea of making a flight to New York and back in record time, it was suggested that he should visit Montreal, where an aviation meeting was in progress at St. Hubert aerodrome, but on Saturday, August 20, a thick fog prevented this scheme from being carried out. Instead, Mr. Mollison continued his flight to New York, on Sunday, August 21, arriving at Roosevelt Field at 4.35 p.m., having flown from St. John, New

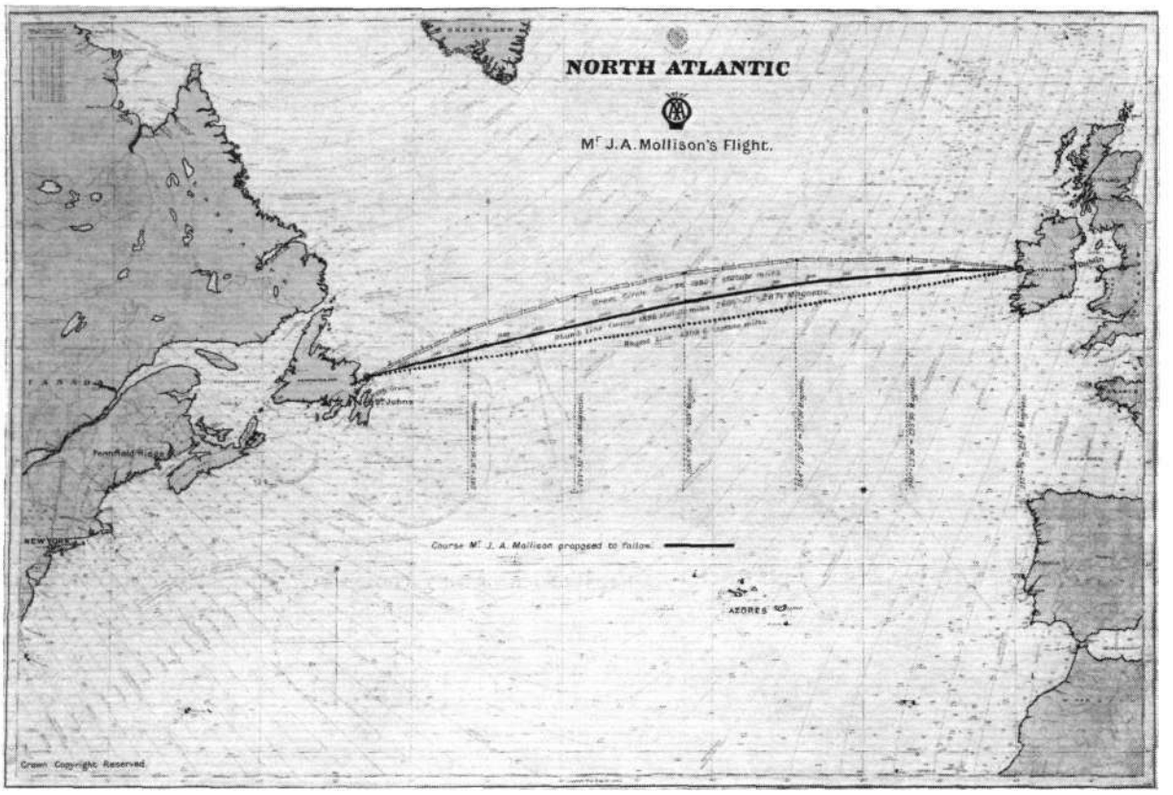


Chart showing route prepared by the Automobile Association.

Brunswick, in about 5¼ hours. The distance is approximately 600 miles. At New York Mollison was given a great reception.

Among the sheaves of congratulatory messages received by Mollison and by his wife Amy, we have space to quote but a very few.

Mr. Ramsay MacDonald sent the following telegram from Lossiemouth: "A wonderful flight, calling for our heartfelt admiration. Many congratulations."

From the Air Minister, Lord Londonderry: "On behalf of the Air Council I send you warm congratulations on your great flight from east to west, which has once again given striking proof not only of your personal skill and courage but also of the efficiency of British aircraft and British aero engines."

From Lord Wakefield of Hythe: "My heartiest congratulations on the success of your record-making flight. I sincerely trust your return flight will be crowned with equal glory to yourself and your country."

The Royal Aeronautical Society sent the following: "President and Council of Royal Aeronautical Society send you warmest congratulations on your magnificent flight, a wonderful triumph of British confidence in a British aeroplane.—Pritchard, Secretary."

We publish a chart of the route which the Aviation Department of the Automobile Association had planned for Mr. Mollison. A few words of explanation may be of interest.

The shortest distance between the coasts of Ireland and Newfoundland would have been a great-circle course. To fly along this, however, Mr. Mollison would have been obliged to make five changes of course at predetermined points, and would therefore have had to calculate his position with considerable accuracy. Flying solo as he was, this would have presented great difficulty. An alternative would have been to follow a rhumb-line course, but this would also have involved changes of course to correct for the changes of magnetic variation. To overcome these difficulties, the rhumb-line course was taken, and to this was added the average difference in the magnetic variation between Ireland and Newfoundland. On this course the pilot would be north of the rhumb line, as the average magnetic variation at first exceeded the actual. Halfway across the actual and average variation would be the same, and finally on the second half of the Atlantic crossing the actual would exceed the average variation, and the pilot would find himself gradually approaching the rhumb line.

"THE HEART'S CONTENT": Mollison's "Puss Moth" (Gipsy III), which crossed from Ireland to Nova Scotia in 24 hours. (FLIGHT *Photo.*)

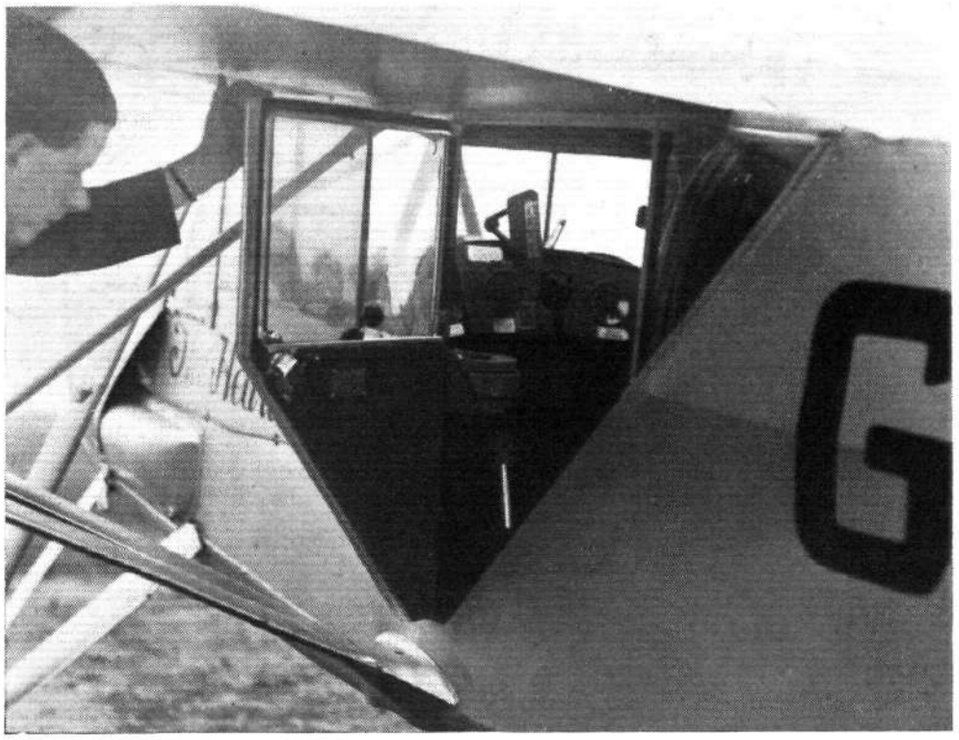
The Equipment

The "Puss Moth" used by Mr. Mollison was a perfectly standard machine in every way as regards its primary structure, which had not been altered or strengthened, in spite of the great load it would have to carry. The alterations made were to the petrol-tank arrangement, the situation of the pilot, and the removal of wheel and air brakes to save weight.

In addition to the two petrol tanks in the wings, each of 20 gallons capacity, a large tank of 75 gallons was installed in the forward part of the cabin, and another tank, of 47 gallons, behind the cabin. The total tankage was 162 gallons, which was estimated to be sufficient for about 33 hours' flying.

The tare weight of the machine was 1,316 lb., and when the machine took off from Ireland it weighed 2,754 lb. This represented an overload of approximately 700 lb. Yet, in spite of this, the take-off from the beach at Portmarnock took only 28 sec. A message from Mr. Mollison received by the de Havilland Aircraft Company indicates that neither machine nor engine objected to the overload, but behaved in a most exemplary manner. Mr. R. A. Loader, manager of de Havillands in Canada, sent two engineers to St. John, New Brunswick, to examine machine and engine, and their report was as follows: "Mollison's 'Puss Moth' and 'Gipsy' in perfect condition. Appearance as if flown 50 miles. No replacements required. Oil change at St. John this morning showed a consumption, for the 30 hours, of only 3¼ gallons. Machine now ready for return flight."

The pilot's seat was shifted from its usual position, just behind the windscreen, to approximately the place normally occupied by the passenger's seat. The space left here by the two large petrol tanks was not large, but sufficed, as Mollison could not very well get up and walk about in any case. The view forward was not, of course, quite as good as in the standard machine, but as the air over the Atlantic is not yet very crowded with aircraft, that did not matter very much.



"THE OFFICE": Seated between petrol tanks, Mollison had in front of him a very complete set of instruments. (FLIGHT *Photo.*)

In front of him Mr. Mollison had an instrument board with the usual set of Smith's instruments. On each side, slightly lower down, was a Husun P-4 aperiodic compass. In addition to his two compasses Mr. Mollison was aided and abetted in his course-keeping by a Reid-Sigrist turn indicator, and the fact that he struck the coast of Newfoundland and arrived over Halifax according to schedule seems to indicate that the navigation was very good indeed, especially in view of the fact that Mollison was flying solo, and had his engine instruments to watch as well, not to mention the actual handling of the aircraft, although probably by now the latter has become so absolutely instinctive to him that he could "do it in his sleep."

The de Havilland "Puss Moth" is already well known and needs no description, beyond recalling that the fuselage is of metal construction, Reynolds steel tubing entering largely into it. The monoplane wing is mainly of wood construction, and the whole is fabric covered. Mollison's machine was doped with Titanine "Satin Finish" dope, and it may be this which caused the Canadian engineers to report that the machine looked as if it had only flown 50 miles.

Normally the "Puss Moth" is fitted with wheel brakes, but in this instance they were removed from the Dunlop wheels to save a little weight.

The "Gipsy III" engine has now proved its worth on many arduous flights, and once more it was found equal to the occasion and ran without a hitch, its Hoffmann ball bearings reducing friction losses to a minimum, its B.T.H. magnetos firing its K.L.G. plugs with the customary precision and regularity.

(*Concluded at bottom of next page.*)

WORTH ITS WEIGHT IN PETROL: This photograph shows where the 162 gallons of fuel were carried. (FLIGHT *Photo.*)

A Stratospherical Record

Record Balloon Ascent by Prof. Piccard. 10½ Miles Up

ON Thursday, August 18, Professor Piccard, the Belgian scientist and aeronaut, accompanied by M. Cosyns, made his second balloon ascent to study the cosmic rays in the stratosphere. Last summer, it will be remembered, he rose to a height of just under 10 miles, which constituted a world's record. His companion on that ascent was M. Kipfer. On that occasion they had to descend on an Alpine glacier, and suffered some hardships before they got back to civilisation. The special gondola in which they made the ascent rolled down some distance after they had left it, and was only recovered with difficulty.

On the present occasion the start was delayed for some days in order to get favourable weather conditions. The balloon, with its new and improved spherical air-tight gondola, was held in readiness at Dubendorf aerodrome, near Zurich. On Wednesday a favourable weather report

Professor Piccard tries to avoid publicity.

was received, and it was decided to make the ascent early next morning.

By 4.10 a.m. everything was ready, but the Professor decided to wait for the atmosphere to get a little warmer. The balloon was only partially inflated with hydrogen, so as to allow for expansion when it rose into the upper air, and it presented a very elongated appearance at the start. Just at the moment of embarkation a telegram of good wishes from the King of the Belgians and one from the Swiss President were received by Professor Piccard. Before setting off, he stated that it was not his object to beat his altitude record of last year; in fact, he might not go so high as he did last year. His object was scientific discovery, not mere record-breaking.

A few minutes after 5 a.m. the order was given to let go, and the balloon commenced to ascend. The porthole of the gondola was left open, and the Professor looked out and cheerily waved to the great crowd. The sky was cloudless, for a great anticyclone lay over Europe, and the balloon was seen at intervals from various points during its 12 hours' flight, even when it was at a great altitude. When the port of the gondola was closed, the heat inside became intense for a time, but as the height increased the temperature sank lower and lower until the thermometer registered 32.8 deg. below zero (Fahrenheit), which means nearly 65 deg. of frost. The gondola was painted white outside to reflect the rays of the sun, instead of black as last year. The two aeronauts suffered intensely from the cold, and the Professor afterwards said that he feared that they would be frozen to death.

In three hours the balloon reached its maximum height of 16,700 m., or nearly 10½ miles, thus beating the altitude record of last year. By that time the gas had fully expanded, and the balloon had become spherical. The sky was dark at that height, but a glorious view of the earth below was obtained, and the Professor regretted that his work at his instruments prevented him from giving more time to enjoying the view. The balloon was drifting slowly over Switzerland, and the Professor was quite familiar with the country and knew all the lakes which passed beneath, so he never felt lost. The balloon passed over the Engadine and then moved eastwards to Austria. Then it turned southwards, moving at a speed of some 25 m.p.h. At 11.40 a wireless message was received from the balloon (from which a fairly regular supply of messages had been despatched) saying the Lake Garda was in view and they would soon descend to avoid falling into the Adriatic.

About 3.45 the balloon was seen from Milan, and before 5 p.m. it was sighted at the north end of Lake Garda, descending at a steady rate. At 5.10 it came to earth at the village of Cavallara, between Mantua and Desenzano. Desenzano is the station of the High-Speed Flight of the Royal Italian Air Force, and as the balloon came in sight our old friend Col. Bernasconi went up in a seaplane and followed it. The Professor opened the port in the gondola and signalled to the colonel that he was landing. The balloon came down in a cornfield, and the gondola bumped once before coming to rest. It was slightly damaged, but the men were unhurt (it is said that their wicker crash-helmets saved them), and the all-important instruments were also undamaged. They were the first care of the aeronauts before they would leave their car. The balloon was first taken in charge by a party of local villagers, but the Professor had to shout to them not to smoke, and he must have been very pleased when soldiers arrived and relieved the villagers.

The heat on the Italian plains at the time of the landing was about 98 degrees in the shade, and the change in so short a time from intense cold to great heat caused both men to collapse for a time. They lay helpless beside the gondola for some time until they began to revive. The Professor expressed himself as satisfied with the results of his ascent, though he was not able to say much on the subject until his instruments had been studied. Telegrams of congratulation were soon received from all quarters, chief among them being messages from the King of the Belgians and from Signor Mussolini. The Italians, with their wonted hospitable spirit, did everything possible to help the Professor. He was greeted everywhere as a hero, but, as our illustration shows, he did all in his power to avoid publicity.

The flight was financed by the Belgian National Research Fund.

MOLLISON'S ATLANTIC FLIGHT

(*Concluded from previous page.*)

On a flight like that just made by Mr. Mollison, when all sorts of weather may be encountered, the question of an airscrew that will stand up to rain, snow and, if necessary, hail, assumes great importance. Mr. Mollison chose a Fairey metal airscrew, and although it was not called upon to act as a cheese-cutter, it *was* definitely an important item in influencing the fuel consumption per mile flown.

If we add that Mr. Mollison's flight was made on Shell spirit and Castrol oil, we think we have given full credit where credit was due, and everyone concerned can be very proud of their share, small or large, in an endurance flight which has once more placed British aircraft material in the limelight. The de Havilland Company in particular is to be congratulated on now holding, with their "Puss Moth," the records for the first South Atlantic and North Atlantic solo flights (the former made by Bert Hinkler), as well as other, and even more strenuous, flights over land to Australia and South Africa.

Private Flying & Gliding

READING NOTES

During the past week the Phillips and Powis School of Flying have been very busy, especially with taxi work. Last Sunday Mr. S. B. Cliff, pilot in charge at Bristol, made a trip to Naples; the flying time out was only 13 hr. 30 min., and back 12 hr., for the trip of 1,260 miles. Another trip was made to Newcastle and one to Marlborough.

The fine weather lately has had a good effect on the flying hours, and has also made pupils very enthusiastic about their flying, the following having obtained their "A" licences:—Mr. H. W. Duffey, of Ivor; Mr. W. K. Liversidge, of Coventry; Mr. A. P. Gray, of Farnham Royal; Mr. J. Thomas, of Henley, and Mr. E. S. Godivala, of Poona, who is training for his ground engineer's licences.

Among the new pupils at the School this week is Mr. Karl Von Loesch, of Germany, who has now passed all his tests for the "A" licence.

A Cirrus Avian has been sold to Mr. Norman, of Air Service Training, Hamble, and a "Gipsy II Moth" to Mr. Micklethwait, of Leeds.

The repair shop has had a new influx of work. Two damaged machines from abroad, one from France and one from Spain, are on their way to the workshops for repair. Five other machines are in the process of being rebuilt. The engine shop has done its bit by turning out three complete engine overhauls for various clubs during the last fortnight.

(Left) Mr. C. O. Powis, Managing Director of Phillips-Powis, Ltd., Reading and (right) Mr. H. W. Sear with his new Moth (Gipsy III) which he is flying back to Kenya.

SYWELL NOTES

The Northants Aero Club are holding the last of the "Away from Home" Meetings this year, on Saturday, August 27, when they are arranging their second flying show at Llandrindod Wells. Last year the meeting was one of the most successful held anywhere, the local enthusiasm being very keen; everything points to a jolly time on the 27th. All those pilots who are willing to help will be heartily welcomed. A Ladies' "At Home" will be held at Sywell on Sunday, September 25, when there will be a competition for the silver challenge cup won by Miss Slade at the Ladies' Flying Meeting at Sywell last September. Further details of this competition will be announced in FLIGHT next week, but it will not be a race. All pilots are asked to keep this date free.

JOHANNESBURG LIGHT AEROPLANE CLUB

The Johannesburg Club has been flying actively since 1927 and up to the end of last year their machines had flown about 626,310 miles, of which 170,000 were done in cross-country flights. There was a slight decrease in flying hours last year, when the Club machines put in 2,314 hr., but the difference between this and the average of the previous years, of 2,460, is very slight. The total number of passengers carried by the Club aircraft since 1927 is 7,633, of which number 1,962 were carried last year.

LIVERPOOL AND DISTRICT AERO CLUB

July was not so good as June, chiefly on account of less good weather. None the less total figures for the year are eminently satisfactory, those for 1932 being 1,221 hr. as against 1,049 hr. for 1931.

Some inconvenience has been caused to Lt. Col. Stevenson and to users of the tennis courts owing to club members booking courts in advance and then not using them.

We understand that at present no cash forfeit attaches to this, but it is obvious that the courts cannot be organised in the best interests of all concerned unless individuals are prepared to be more considerate.

The "Week-End" Aérien.

On Friday, September 2, the foreign visitors of the *Week-End Aérien* should reach Hooton from 4.30 p.m. onwards.

The General Purposes Committee has handed over the ground organisation of the reception to a committee consisting of Flt. Lt. Clapham and Messrs. Gairdner, Grenfell, Dawson and Thornton.

This committee will require a number of active and willing stewards, and all members able to serve either on Friday afternoon or Saturday morning are asked to give their name to the Secretary.

The House Committee are organising a garden party for the afternoon, and it is hoped that the maximum number of members, friends and neighbours will turn up between 4 and 6 p.m. to help in making the welcome to our foreign visitors a really pleasant one. Stewards will be wanted to assist in this connection also.

On Saturday, September 3, the visitors will be leaving the ground probably between the hours of 12.30 and 2 p.m.

The Committee responsible for the organisation of the Inter-City Air Race on September 3 has decided that it be held this year on Saturday, September 3, starting and finishing at Hooton. The start will be at 3 p.m. The public will be admitted to the aerodrome from noon onwards at the usual moderate charges.

A change has been made in the conditions and the race is now open to any private owner or firm. Terms and conditions of entry may be obtained from the Secretary to the Committee, D. H. Bartrum, Esq., Airport of Manchester, Barton, Lancashire.

The course will be approximately in the reverse direction of that used last year.

THE BRITISH GLIDING ASSOCIATION

The British Gliding Association are staging a big competition from August 25 to September 4. The site on which the competition is being held is at Moorside, Askam, near Barrow-in-Furness.

There will be three major contests—distance, duration, altitude—in each of the six classes running through the competition, on primary training machines, secondary type gliders, sailplanes, and two-seater machines. All the contests are under the rules and regulations of the F.A.I. (Fédération Internationale Aéronautique), who will recognise all records which may be made during the competition.

Special prizes in the form of trophies, *i.e.*, the "Lord Wakefield" trophy, the "Manio" Cup, the "Volk" Cup, and the "de Havilland" Cup, are offered, in addition to which there are special prizes for women and other special prizes for the machines making the highest aggregate flying time in each class. A camp has been formed.

The programme starts at 7 a.m. daily, and flying will probably cease about 6 to 7 p.m.

BROOKLANDS

Flying times at Brooklands for the past week have totalled nearly 100 hr., made up mostly of instruction, but including also a considerable amount of solo by qualified pupils and a number of joyrides.

On the instructional side considerable progress has been made, and six new "A" licences have been gained by Brooklands pupils. Mr. Hett has done his first solo. Among the new pupils who have joined the School is Mr. Haywood of Hawker's, Ltd., the manufacturers of the famous "Hart" and "Fury."

Mr. Danson has commenced a course of blind flying, and Mr. Frierson has entered for the blind flying competition. This, by the way, has been specially prolonged so that everyone may have a chance to enter. It will be remembered that each entrant is given a free trial blind flying lesson lasting for 15 min., and that the best of them will be selected from the results of this and further trials. The prize will be a full course in blind flying.

The trial lesson may be taken at any time and on any day, and those private owners who contemplate flying near Brooklands are cordially invited to advise beforehand so that a test may be arranged to suit their convenience. Entries should not be delayed very much longer, as a definite closing date will soon have to be announced.

Capt. Davis and Mr. Edward Walter have been making a flying tour of the country, during which they have visited nearly every English aerodrome. A fairly leisurely circuit of the country in this way makes a very enjoyable holiday, and the idea is commended to private owners in need of a change.

Mr. Ahlers has just returned to Brooklands from an aerial trip to Germany.

Two "Moths" from the Herts and Essex Club at Broxbourne paid us a visit on Friday, and the club's rather novel colour scheme attracted some attention.

Mr. Nelson's Avro "Cadet" and Mr. Vaughan's "Gipsy III Moth" have both been here this week, and in each case the owners have been kept busy giving "sample rides" to friends interested in the machines.

The Personal Flying Services "Junker" is also much in use for air taxi and special charter work.

Mr. Parashar, the Indian pupil, has just completed the 100 hr. solo flying necessary for his "B" licence.

Dual instruction on the Cierva "Autogiro" is to be included in the regular syllabus of the Brooklands School of Flying at ordinary flying rates.

This is an innovation of considerable importance. As most people know, the "Autogiro" has an amazing performance. It cannot be stalled or spun, and it is so simple to handle that it almost flies itself.

Perhaps the most important aspect of the machine is that it will hover nearly motionless in the air and descend vertically and land in a very small space indeed, which enables it to be used for a number of purposes for which an ordinary machine would not be well suited. It will be remembered that traffic proceeding to this year's Derby was directed with the help of the "Autogiro" overhead, which kept in wireless communication with police on the ground.

LONDON GLIDING CLUB

In response to requests from persons who live far from Dunstable, it has been decided to organise another special gliding course at an inclusive fee. This will entitle the pupil to temporary membership of the London Gliding Club for the period booked, use of club machines, first-class instruction and sleeping accommodation on the site.

The course will commence on Saturday, September 17, and will continue until Sunday, September 25, inclusive. It will take place at the London Gliding Club ground at Dunstable—one of the finest gliding sites in the country—usually having excellent soaring winds at this season. In addition to primary and secondary training machines, intermediate and high efficiency soaring machines will be available.

Sleeping accommodation will be provided on the site in tents (not more than four persons per tent) and all meals will be available at strictly reasonable prices in the club-house, which is also equipped with a licensed bar. Official observers will be available to time tests for the Royal Aero Club Glider Pilot's Certificate throughout the course. Pupils are expected to provide their own bedding and camp beds, if required. The use of tents, lamps and washing accommodation is included in the fees.

Inclusive Fees.—9 days, £4; 8 days, £3 15s.; 7 days, £3 10s.; 6 days, £3 2s.; 5 days, £2 15s.; 4 days, £2 6s.; 3 days, £1 16s.; 2 days and less, £1 10s.

Groups of four persons may share a tent by booking together. All fees are payable at the time of booking, and owing to the cost of advance organisation no money can be returned under any circumstances whatsoever. The club accepts full responsibility for damage to machines whilst being flown in accordance with its normal flying rules and regulations, also for damage to third party, but accepts no responsibility for damage or injury to pupils or pupils' personal property.

For obvious reasons the number of pupils which can be accepted under these arrangements is strictly limited, and applications will be accepted in the order of receipt (with remittance), which should be made to the Secretary, London Gliding Club, 35, Milk Street, London, E.C.2.

EASTERN COUNTIES AERO CLUB

The Eastern Counties Aero Club at Colchester has been operating at Blue Barns Aerodrome for 11 months, having started in September last year. During that time they have put in 785 flying hours, and 18 pilots have obtained their "A" licences. The Ipswich branch of the Club has done approximately the same amount of flying. At the present time the Club equipment consists of two "Redwings," and it is hoped that a third will be acquired shortly. The membership of the Club is about 165 at the moment, and several members are proposing to buy aircraft of their own. Hangar accommodation is at present arranged at the aerodrome for three machines, while the Redwing Aircraft Co. have their factory situated at the same place. The Club would at all times be very pleased to see private owners or others who care to visit them by air.

GATWICK

For the convenience of private owners and others wishing to attend the Gatwick race meetings this week, on August 26 and 27, the Redwing Aircraft Co. will have a mechanic stationed on the far side of the aerodrome by the private gate which leads on to the racecourse, to look after the machines whilst the owners are making vast fortunes in the ring, and to swing the props for those gentleman of the bookmaking fraternity who may wish to make a hurried exit from the course. No landing fee will be charged to private owners.

Prof. Piccard's recent altitude record in a balloon recalls the occasion when M. Kippfer, who accompanied Prof. Piccard on his previous epic stratospheric trip, was given a trial lesson in a "Redwing" by Flt. Lt. N. M. S. Russell, the chief instructor at Gatwick, during M. Kippfer's last visit to England. Flt. Lt. Russell said that he had never taken up such a natural pilot before for his first flight.

SINGAPORE FLYING CLUB "AT HOME"

The Royal Singapore Flying Club recently held an At Home during which over 75 passengers were carried by their three "Moth" seaplanes. This club is unique in that it is to the best of our knowledge the only civil flying club employing seaplanes exclusively. The keenness with which the people in that part of the world have taken to flying may be judged from the fact that in a little over four years the club has amassed a membership of 240 and has turned out over 80 qualified seaplane pilots. On July 26, the day of the "At Home," perfect weather made conditions ideal and the guests were received by Wing Com. Lundon and Mrs. Lundon, while tea was served on the lawn to the accompaniment of music provided by the R.A.F. Band. Mr. R. H. Potter, the chief instructor, assisted by Messrs. Roberts, Rhodes and Shook put in some 880 min. flying between them from 2 p.m. until 6.30 p.m., taking up passengers in the three "Moths" (Hermes) and the club's "Cutty Sark." Messrs. Potter, Watts and Rhodes gave a very fine display of formation flying in the "Moths" and after a dive at the clubhouse, which finished with the Prince of Wales' feathers, they reformed and landed in formation. A rather interesting method of advertising the club's work was adopted by the showing of a cinema film which covered the whole of the club's activities including flying, photographic and ground work.

WOMEN ENGINEERS' MEETING AT SOUTHAMPTON

In connection with the Annual Conference of Women Engineers, who have recently formed an Aeronautical Section, it has been decided to hold a Women's Flying Meeting at Stoneham Park, Southampton, on Sunday, September 18. This will be the second Women's Air

meeting, and as the first, held at Sywell last year, was a great success, everything points to a good show at Southampton. An ambitious programme is in course of construction, and already many famous pilots have promised their help.

BRISTOL AIRPORT

Traffic figures at Bristol for the first half of the current year show an increase of over 25 per cent. over the corresponding period for 1931. Private owners from the Metropolis are making Bristol Airport an established rendezvous for lunch and tea on Saturdays and Sundays.

On Saturday last Mr. Stephen Cliff returned from Naples with Phillips and Powis' "Desoutter" air taxi, after a week's charter in Italy. Mr. Cliff left for Ireland two days later on a fortnight's holiday, and during his absence the air taxi work will be carried on by the Bristol and Wessex Aeroplane Club.

Mr. A. H. Downes-Shaw, the Chairman of the Bristol Club, completed a three weeks' holiday tour with his "Gipsy I Moth," during which he visited Scotland and Ireland. Lt. Col. Smith-Barry, who is also a member of the club, cleared customs at Bristol for Ireland on Saturday, returning for inwards clearance on the Tuesday evening.

On Friday, September 2, the machines visiting England for the *Week-End Aérien* will land at Bristol, when the pilots and passengers will be entertained to luncheon at the Airport by the Lord Mayor of Bristol and the Airport Committee of the City Council. Lunch will be taken in the main Airport hangar, and preparations are being made for 170 guests.

Since August 1 eight pupils have completed the "A" licence tests with the Bristol and Wessex Club, and a further eight are still under instruction.

GLIDING IN INDIA

A great step forward in aviation in India was recently taken by the Indian Gliding Association of Bombay by opening a camp at Aundh for training its members in this art of "motorless-aeroplane flying."

The Association ordered out since its inauguration in September last some of the best German and American machines, on the advice of the British Gliding Association. They arrived in the "kit" form, which gave the members an opportunity of gaining experience of assembling the craft.

The machines are of the most up-to-date designs. The Association now owns three types of gliders, known as "Primary," "Secondary" and "Semi-Soarer," and is also contemplating the addition of a true "Sailplane."

Since the training of students was started at the Camp several have gained sufficient experience to qualify for their "A" certificates. Among the advanced students are two Indian ladies, including Miss Krishnakumary Pant, a daughter of the Chief of Aundh, himself a patron.

The Association has 180 students on the roll, and is striving to popularise gliding among the youth of the country. It is affiliated to the British Gliding Association.

THE WEEK-END AÉRIEN

As this is the last issue of FLIGHT before the *Week-End Aérien* becomes *fait accompli*, we should like to stress the point that it is essential that tickets be purchased by all those British pilots who wish to participate in any of the arrangements. A complete book, which includes all the functions in London, Bristol and Liverpool, but not accommodation for the night in London, costs £4 19s. 6d. For those who only wish to join the party on certain of the days, separate tickets may be purchased. £1 4s. 6d. will cover Thursday's festivities, including lunch at Heston, conveyance to the Mayfair, back to Poulsens' Club at Datchet and back to London again, also supper, dance and light breakfast at Poulsens', inclusive of drinks. On Friday, September 2, a ticket costing £1 18s. 6d. will cover lunch at Bristol, dinner in the S.S. *Adriatic* and bed and breakfast at the Adelphi Hotel, Liverpool, as well as ground transport. Saturday's dinner, dance and cabaret at the Mayfair costs £1 12s. Those who have not purchased the complete set of tickets will have to pay a small extra sum for transport to London from Heston on this day. Subscriptions towards the funds, which will enable the foreign visitors to be entertained in a manner no less generous than our pilots have received when paying visits abroad, may still be sent to the Secretary, Room 170, Mayfair Hotel, London, W.1, and those who feel that we owe a debt to those visitors (and who does not?) should send their contributions as soon as possible.

Air Transport

Air Service for Hull

AN experimental air service between Hull and Grimsby will (it is reported) be started in September. It will start from Hull municipal aerodrome at Hedon each morning at 9 a.m. and carry passengers and parcels to Humberstone, three and a-half miles from Grimsby, leaving Humberstone on a return journey to Hull at 9.30 a.m. An afternoon service will leave Hedon at 4.30 p.m. and Grimsby at 5 p.m. The return fare will be 14s. At present the journey to and from Grimsby and Hull involves crossing the River Humber in a steamer to New Holland and then entraining for Grimsby. The journey, moreover, occupies an average time of an hour and a-half. The time occupied in flying from Hedon to Humberstone occupies 10 min. Passengers will be able to get from the centre of Hull to the centre of Grimsby in just under 40 min.

Proposed Air Mail to Australia

IN our issue of August 19 we mentioned the scheme now under consideration for Imperial Airways to extend their present Eastern service from Karachi to Singapore, where it would connect with an Australian company, probably to be formed by a combine of the principal companies now operating in Australia. An alternative scheme, in which it is understood that the Larkin Company is interested, is for the Dutch Air Service, which already flies from Amsterdam to Batavia, to extend its route to Wyndham, and there connect with an Australian company. It is reported that the Dutch line would charge £8 for the first 100 kilos, and £6 for every additional kilo, which would work out at a postal charge of over 2s. per half-ounce letter. Apart from the charge, it seems hardly likely that the Australian Government would agree to British mails being carried on foreign aeroplanes.

Air Services in Norway

THE Norwegian postal authorities felt themselves unable, for economic reasons, to carry on the air services which had been in operation during the months of June, July and August, 1931. Last summer there was a nightly air mail service between Oslo and Gothenburg, with one flight each way every night. Between Gothenburg and Copenhagen, the point of connection with the Continental air routes, the mails were carried by the Swedes. The machines and pilots used by the Norwegian postal authorities were hired from the Ministry of Defence. Last year, from May 18 until September 12, there was also a passenger service from Oslo to the Continent carried out by the Deutsche Lufthansa A/G in connection with the Norske Luftruter A/S. The route was Oslo-Gothenburg-Copenhagen-Lubeck, with one machine daily each way.

Faster Mail Service from Rangoon

THE agents of the K.L.M. in Rangoon have received intimation that the Government of India has decided to extend the privileges at present accorded to the company. The K.L.M. may pick up at Rangoon mails for Europe and carry them to Calcutta to be delivered there to the postal authorities for onward transmission. At present the air mail is posted on Wednesday. By the new route it may be posted on the following Saturday night, being taken by the K.L.M. early Sunday and reaching Calcutta on Sunday afternoon, thence going by mail train to Karachi, arriving there on Wednesday morning in time to catch the Imperial Airways machine. Thus the homeward air mail will take ten days from Rangoon to the United Kingdom instead of fourteen days. Another important change is that mails from India and Burma for other countries in the East may be loaded at Calcutta, Akyab or Rangoon, thus providing Rangoon with an air mail service in both directions.

Airisms from the Four Winds

The Lure of the Atlantic

THREE flights across the Atlantic were started on August 23. Mr. Thor Solberg, with Mr. Carl Petersen as wireless operator, left Floyd Bennett Field, New York, at 5.43 a.m. (10.43 a.m. B.S.T.), in a "Bellanca" sesquiplane for Harbour Grace; from there they will endeavour to fly direct to Oslo. The latest news is that they crashed at Darby's Harbour, 50 miles from Harbour Grace, damaging their aircraft but themselves escaping injury.

The second flight, also with Oslo as its ultimate destination, is that of Mr. Clyde Lee and John Bochkon, who took off from Barre (Vermont) for Harbour Grace at 10.18 a.m. (3.18 p.m. B.S.T.) in a "Stinson" monoplane named the "Green Mountain Boy," without wireless equipment. They landed safely in due course.

The third flight is that of Mr. G. R. Hutchinson; his wife and their two daughters, aged six and eight; Mr. P. Redpath, navigator; Mr. J. Ruff, mechanic; Mr. G. Altissich, wireless operator; and Mr. N. Alley, photographer. They left New York at 11.7 a.m. (4.7 p.m. B.S.T.) in a twin-engined "Sikorsky" amphibian to make a leisurely journey to London via Newfoundland, Labrador, Greenland, Iceland and Edinburgh. They completed the first stage successfully when they landed at St. Johns, Newfoundland, at about 4.0 p.m. (local time) the same afternoon. They expect to take about five days over the journey.

A flight to Rome is proposed by Mr. W. Ulbrich and Miss Edna Newcomer, together with Dr. Pisculli, who expect to take off shortly from New York.

No Trace of Salt and Taylor

THE aeroplane in which the British planters, Salt and Taylor, set out from Moulmein to fly to England, via Rangoon, was definitely sighted on August 12, both in the morning and in the afternoon, according to a report by the Deputy Commissioner at Rangoon on August 22. In the afternoon it was seen flying in a north-westerly direction over the mouth of the Sittang River, which leads to the apprehension that the airmen fell into the sea.

Since then, in spite of intensive searches, nothing has been heard of the missing flyers.

Commander Hall, of the Royal Australian Navy, who is flying from England to Australia in a Bluebird (Hermes), after several hours' further vain search inland, has returned to Moulmein. The search party which set out from Hanthawaddy has returned to Rangoon without any news, and nothing has been heard from the party which started from Pegu.

Feminine Endurance

AFTER flying for 196 hr., two American airwomen, Mrs. Frances Marsalis and Mrs. Louise Thaden, landed on August 22 at Curtiss Field, New York, having broken the women's refuelling endurance record by 73 hr. They took off at 2 p.m. on August 14. The previous record was 122 hr. 50 min. set up at Los Angeles last year by Miss B. Trout and Miss E. May.

Italian Officers at Hamble

LT. COL. LANCIANI and LT. DE WITTEMBERSKI, both of the Italian Air Force, have joined the Air Service Training Flying School at Hamble with the intention of taking the Blind Flying course. It is seldom that one hears of Italian officers going away from their own country for flying instruction, and we may take it as a compliment that these two officers have chosen one of our flying schools in which to obtain their experience on this very necessary branch of flying.

French Air Manœuvres

MARSHAL PETAIN, Inspector-General of Air Defence in France, is busy holding a series of air exercises in various parts of the country. An important feature of these exercises is that the inhabitants of the area attacked are required to extinguish lights and take refuge in air raid shelters.

Indian Aircraft Rules

FURTHER amendments to the Indian Aircraft Rules, 1920, have been drafted by the Government of India. New categories of licences for pilots of aircraft for limited transport of goods and passengers within India (A1 licence), pilot instructors and wireless operators have been introduced and revised scales of fees laid down. Among other changes introduced, the flying experience required of an applicant for the grant of renewal of an "A" licence, has been raised from 3 hours solo flying within the preceding twelve months to 5 hours solo flying within the preceding six months; in the case of "B" licence, it has been raised from 100 hours to 200 hours solo flying, of which not less than 15 hours are required to have been performed during the preceding six months and not less than 5 hours by night. Provision has been made for the validation, for the purpose of flying craft registered in British India, of licences issued by the competent authority in any part of His Majesty's Dominions outside British India or in any foreign State. In this connection all pilots who hold current licences granted by the British Air Ministry and who desire to fly Indian registered aircraft are required either to take out corresponding Indian licences or to forward their British licences to this Directorate for validation.

Post and Gatty Decorated

PRESIDENT HOOVER, of the U.S., has decorated Messrs. Post and Gatty with the Distinguished Flying Cross in recognition of their world-encircling flight, which they made in June, 1931, their time for the flight being 8 days 15 hr. 51 min.

Oil Prospecting by Air

AN important development in the search for oil in Australia has been begun by the departure for Northern Australia of a Royal Australian Air Force squadron, consisting of the aerial survey flight recently arranged between the Minister for Defence (Sir George Pearce) and the Commonwealth Geological Adviser (Dr. W. G. Woolnough).

The object of the expedition, according to a statement by Australia House, is to determine to what extent the technique of aerial photographic survey can be applied in Australia. A preliminary test of the method at Longreach, Queensland, in January proved satisfactory.

The first base of the expedition, which will consist of two aeroplanes, will be Darwin. When the area within reach of Darwin has been investigated, the base will be moved to Fitzroy Crossing, Western Australia, with a base at Broome. A reconnaissance will then be made of Exmouth Gulf, with Onslow as a base, and the expedition will move on to the Wooramel River district, south-east of Carnarvon, Western Australia. Later, the party will make observations north and south of the Transcontinental railway, on the Nullarbor Plain, and the work of the expedition will conclude with an examination of the coastline from Adelaide to Melbourne.

Air Union Extension

A REPRESENTATIVE of the French Air Union Co. is reported to be in Algiers consulting with the Algerian Government about extending the present Tunis-Bona air line as far as Algiers via Constantin. It is thought that the Algerian Government will make arrangements with the Air Union Co. to start this new line next year.

Abingdon Aerodrome

THE new aerodrome at Abingdon will be in use shortly. The advance party for station headquarters will form at Abingdon on September 1, and arrangements have been made for the posting of the *personnel* for this party. Station headquarters will be formed with effect from October 8. No. 40 (B) Squadron will move from Upper Heyford to Abingdon with effect from October 8, and the Station Flight, Upper Heyford, will move to Abingdon with effect from October 28.

British Arctic Air Route Tragedy

MR. H. G. WATKINS, leader of the British Arctic Air Route Expedition, lost his life while seal hunting in a Kayak off the coast of East Greenland on Saturday, August 20. He had established the base of the expedition early this month at Lake Fjord, 100 miles north of Angmagssalik, which is 50 miles north of the limit of Eskimo settlements. With the party were Messrs. Rymill, Riley, and Chapman, and from this base they hoped to make exploration flights on most days of the coming year. Mr. Watkins led the 1930-31 expedition, which Flt. Lt. Cozens recorded in a film entitled "Northern Lights."

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

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THE DETERMINATION OF AIRSCREW DESIGN CONDITIONS

By Lt.-Col. J. D. BLYTH,* O.B.E., A.F.R.Ae.S., M.I.Ae.E.

A CONDITION generally laid down for the test flights of an aeroplane is that the airscrew shall be so designed that it is impossible to exceed the maximum permissible R.P.M. of the engine in level flight, or the normal R.P.M. at the best climbing speed; and in estimating the performance of a machine it should be assumed that this condition is fulfilled.

Except in rare cases, it is impossible to design an airscrew which will give maximum efficiency and R.P.M. at top speed in level flight, and normal R.P.M. on climb: since the relationship between R.P.M. at top speed and at climb will depend upon two factors, the slope of the power curve against R.P.M., and the pitch/diameter ratio of the airscrew. The latter determines the torque coefficient curve which may in turn be modified by variations in blade width.

Until comparatively recently the maximum permissible R.P.M. of an engine exceeded the normal R.P.M. by 10 per cent. With this relationship existing, it was generally safe to assume that the airscrew would be designed to give maximum efficiency at maximum R.P.M., at top speed, as the climbing revs. would not exceed normal in most cases. Lately, however, the amount of over-revving permitted has been increased to 15 per cent. and in some engines 20 per cent. above normal: and two conditions have to be taken into account in determining the airscrew characteristics. These are the design conditions, and are that the airscrew shall give normal R.P.M. on climb and maximum efficiency at a predetermined value of R.P.M. and speed. The latter will usually be the R.P.M. reached at top speed. and will fix the diameter and pitch of the airscrew, while the climbing condition will determine the plan form.

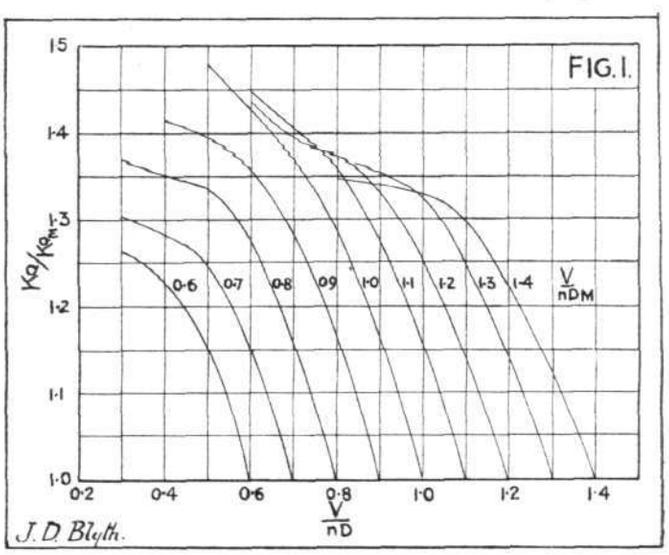
The problem which presents itself at once is the determination of the R.P.M. at top speed. This may be found by trial and error; that is, by assuming a pitch diameter ratio and proceeding to find the R.P.M. at various speeds by the usual methods of performance calculation, and, if the airscrew does not fill requirements, modifying it and repeating the process. With practice the preliminary assumptions can be made with fair accuracy; but if they are incorrect time and labour are wasted.

The object of this article is to provide a means of estimating to a close degree of accuracy what the R.P.M. at top speed will be, and so of allowing the airscrew characteristics to be determined after a very short preliminary investigation.

The first step is to obtain an approximate value of the maximum speed attainable. To do this the curve of thrust horse-power required for level flight is plotted against speed for the machine under consideration, and an estimate made of the nett airscrew efficiency and maximum R.P.M. reached. The latter gives the thrust horsepower available, and from this and the curve of power required the maximum speed is obtained.

In this preliminary estimate great accuracy in guessing the maximum R.P.M. is not necessary. It will be quite near enough to take the maximum R.P.M. as being about 15 per cent. above normal, the slope of the power required curve being so steep that an error of 50 R.P.M. in the estimate will not affect materially the estimate of the top speed.

The diameter of the airscrew can be calculated now, and, from the assumed R.P.M., the value of $\frac{V}{nD}$ and the nett airscrew efficiency are obtained. If the latter is so different from that at first assumed that the estimated top speed is



* Lt.-Col. Blyth is on the Technical Staff of the Gloster Aircraft Company.

altered, the figures should be recalculated, using the new value of the nett airscrew efficiency as found. It should be noted that the nett airscrew efficiency includes the slipstream factor as described in the article on "The Mutual Influence of Engine and Airscrew Characteristics," published in previous numbers of FLIGHT.

From the top speed so found the climbing speed is obtained; a close figure is given by

$$V_{cl} = 0{\cdot}62\ V_M$$

From this we get

$$N_M = \frac{\frac{N_{cl}}{0{\cdot}62}\left(\frac{V}{nD}\right)_{cl}}{\left(\frac{V}{nD}\right)_M} \quad \ldots\ldots\ (i)$$

The suffices M and *cl* denote conditions at maximum speed and climb respectively.

The conditions to be fulfilled are that,

$$\frac{K_{Q_{cl}}}{K_{Q_M}} = \left(\frac{HP}{n^3}\right)_{cl} \Big/ \left(\frac{HP}{n^3}\right)_M \quad \ldots\ldots\ (ii)$$

In this equation, the left hand side refers to the power absorbed by the airscrew, while the right hand side refers to the power given by the engine. The unknown quantities are $K_{Q_{cl}}$, K_{Q_M}, and $\left(\frac{HP}{n^3}\right)_M$; all that we know about them is that K_{Q_M} is the value of K_Q at maximum efficiency.

In Fig. 1 are plotted curves of $K_Q/K_{Q_{at\ \eta\ max.}}$ (*i.e.*, of K_Q/K_{Q_M}), against $\frac{V}{nD}$ for a series of airscrews whose pitch/diameter ratios are such that maximum efficiency occurs at the values of $\frac{V}{nD}$ shown. The latter correspond to $\left(\frac{V}{nD}\right)_M$.

This set of curves is used to plot the curve of K_Q/K_{Q_M} against $\left(\frac{V}{nD}\right)_M$ for the value of $\frac{V}{nD}$ corresponding to the value of $\left(\frac{V}{nD}\right)_{cl}$ found from the preliminary investigation: in this case K_Q is $K_{Q_{cl}}$.

We now turn to the curve of engine characteristics, *i.e.*, of B.H.P. against R.P.M. At any value of N we can find $\frac{HP}{n^3}$, and, since we have specified normal R.P.M. on climb, we know $\left(\frac{HP}{n^3}\right)_{cl}$. The value of D has been found, and by taking a series of values of N we can plot a curve of $\left(\frac{HP}{n^3}\right)_{cl} \Big/ \frac{HP}{n^3}$ against $\frac{V}{nD}$, taking for V the value of the estimated top speed.

If this curve is plotted on the same base as the curve of $K_{Q_{cl}}/K_{Q_M}$ the point of intersection of the two curves gives the value of $\frac{V}{nD}$ at which

$$\frac{K_{Q_{cl}}}{K_{Q_M}} = \left(\frac{HP}{n^3}\right)_{cl} \Big/ \left(\frac{HP}{n^3}\right)_M$$

which fulfils the required condition.

Equation (i) is now used to determine the maximum R.P.M.

An example will make the method clear.

Suppose that we have a machine whose top speed we estimate to be 150 m.p.h. at 2,600 engine R.P.M.; the B.H.P. at this speed being 594, and the gear ratio 0·552/1.

This gives us D = 11′ 3″, V_{cl} = 93 m.p.h., and $\left(\frac{V}{nD}\right)_{cl}$ = ·586

From Fig. 1, the ordinates of the curves at $\frac{V}{nD}$ = ·586, plotted against $\left(\frac{V}{nD}\right)_M$ give us curve A in Fig. 2.

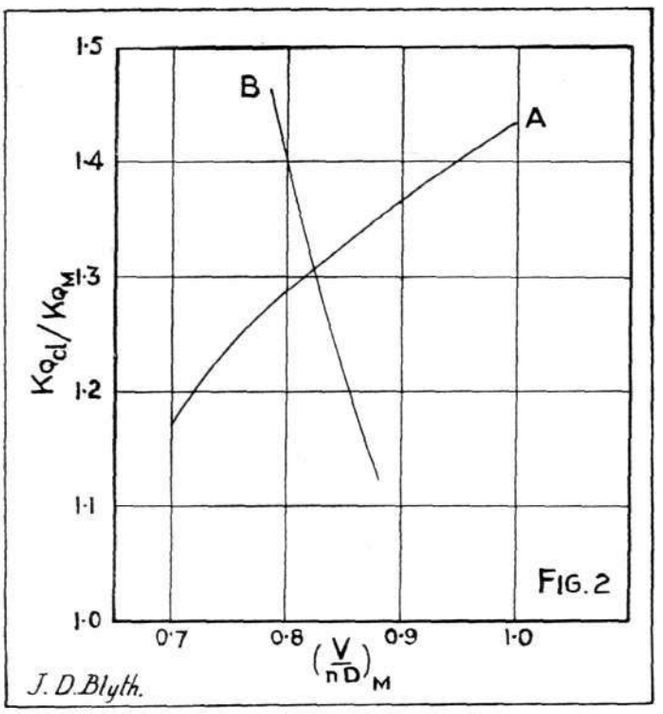


FIG. 2

The curve of B.H.P. against N gives us :—

N	2700	2600	2500	2400	2250 (Normal)	
B.H.P.	610	594	574	550	508	
$\left(\frac{HP}{n^3}\right)_{cl} \Big/ \frac{HP}{n^3}$	1·463	1·345	1·24	1·122	1·0	(*a*)
At 150 m.p.h. $\frac{V}{nD}$	0·784	0·812	0·844	0·881	—	(*b*)

Plotting line (*a*) against line (*b*) in Fig. 2 we get curve B. This intersects curve A at $\left(\frac{V}{nD}\right)_M$ = 0·825, and hence, from equation (i) we find.

$$N_M = 2580.$$

That is to say, an airscrew designed to give maximum efficiency at 2,580 R.P.M. at 150 m.p.h. will hold down to 2,250 R.P.M. on climb at 93 m.p.h.

In the case of a supercharged engine in which the height of maximum supercharge varies with the R.P.M., the value of HP/n^3 must be divided in each case by the appropriate value of the relative density.

STRIP MANIPULATION.

By W. S. HOLLYHOCK.

(*Continued from page* 55)

Spring-back.

It is known from elementary principles that if material is strained beyond its elastic limit it will take a permanent set. The permanent distortion, however, will not be as great as the original distortion under load, the intervening stage—the spring-back—being represented on the stress-strain diagram by the portion of curve between the yield point and the collapse. Collapse in the case of rolled strip is signified, of course, by cracks at the bends.

If R_0 is the radius of curvature to which the metal is required to be bent,
R_1 the radius on the roll
and K a factor dependent on the metal,
then $R_1 = K.R_0$.

With softened steel there is very little spring-back; with Duralumin there is not a great deal—particularly if worked immediately after heat-treatment; while aluminium gives even less. Incidentally, aluminium is not a very reliable metal to work by reason of its extreme softness. It should be worked up in very easy stages to avoid stretching and squeezing. Otherwise, the strip becomes distorted and wanders sideways—producing, at best, a bowed section. Duralumin is little better than aluminium if rolled in the softened condition, but it works up quite well when aged.

TABLE I

Approximate Values of "K" for Various Materials and Bend Radius Ratios

Material	R/t	K	Remarks
Steel ...	1 to 3	0·98	High-tensile, tempered.
„ ...	20 to 30	0·90	„ „
„ ...	1 to 3	0·99	Annealed.
„ ...	20 to 30	0·98	„
Duralumin ...	2	0·98	Aged.
„ ...	20 to 30	0·95	„
„ ...	2	0·99	Rolled immediately after normalising.
„ ...	20 to 30	0·98	„ „ „
Aluminium ...	1 to 3	1·00	To Specification B.E.S.A. L4.
„ ...	20 to 30	0·99	„ „ „

Approximate values of K for various materials and radii are given in Table I. The values of R/t given are such as obtain generally in aircraft practice and cater for really sharp bends where R/t is of the order of 2 and for curved surfaces where the radius is from 20 to 30 times the thickness.

When arranging to take account of spring-back, in laying out the rolls it should be noted that the change of slope is inversely proportional to the change of radius. That is to say,

if (using the same notation) $R_1 = K.R_0$,
then $\alpha_1 = K.\alpha_0$,

where α_0 and α_1 are the corresponding angles between the sides adjacent to the bend (see Fig. 10).

A secondary aspect of the spring-back question is the deliberate re-bending of a section. In some cases it is necessary to bend while rolling a part of the strip which is intended to finish flat, in order to change the attitude of some other portion of the section (as previously mentioned in connection with the forming of a channel section). If the radius to which this flat portion is bent is greater than the critical value, the metal will return to its original state and nothing further need be done to it. If, however, it is necessary to bend it more sharply, it will take a permanent set and must be re-bent in the reverse direction in a later pair of rolls to bring it back to its flat condition.

If R is the radius of curvature,
y the distance from N.A. to extreme fibre,
and f the stress induced,
then, since $E/R = f/y$

$R = Ey/f = Et/2f$ where t is the thickness of the strip; or $R/t = E/2f$.

If f is the yield stress (tension or compression—whichever is the lower), then R is the minimum radius to which the strip can be bent without remaining bent. So that if the radius to which it is bent in the first place is less than this value, re-bending will be necessary and the requisite radius of re-bend will be R.

MATERIALS.

While most metals may be rolled as described, it should be remembered that rolling is (in its aircraft application) essentially a cold process. Consequently, only such material as may be cold worked and does not require any subsequent heat-treatment is suitable.

The material of which the rolls are made is, to a great extent, a matter of individual opinion. Common cast iron, malleable iron, mild steel, cast steel and tool steel all have their merits—and demerits. Longevity, initial cost, brittleness and distortion during hardening are the factors to be considered. A safe policy, however, is to use mild steel in all cases except where very severe work is to be done on high-tensile steel—*e.g.*, the small lips at the extremities of some sections. The force which it is necessary to exert on the sharp edges in such cases results in considerable wear on the rolls. Such rolls or parts of rolls should be of tool steel properly hardened. Where the section concerned is a large one, the rolls will be large, and it is desirable to make them in parts, the idle or lightly used parts being of mild steel (or such other inexpensive material as may be desirable or convenient) and the heavily worked portions of tool steel. This method not only effects an economy in tool steel but renders the hardening and grinding a simpler proposition.

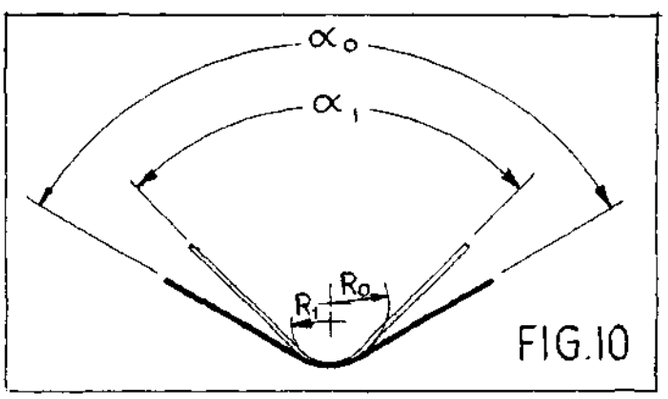


FIG. 10

Case-hardened mild steel is not suitable for rolls on account of the distortion which takes place during hardening and the thinness of the hardened surface, which does not allow for much trueing up after wear or hardening. For soft materials or light work, mild steel may be used without hardening.

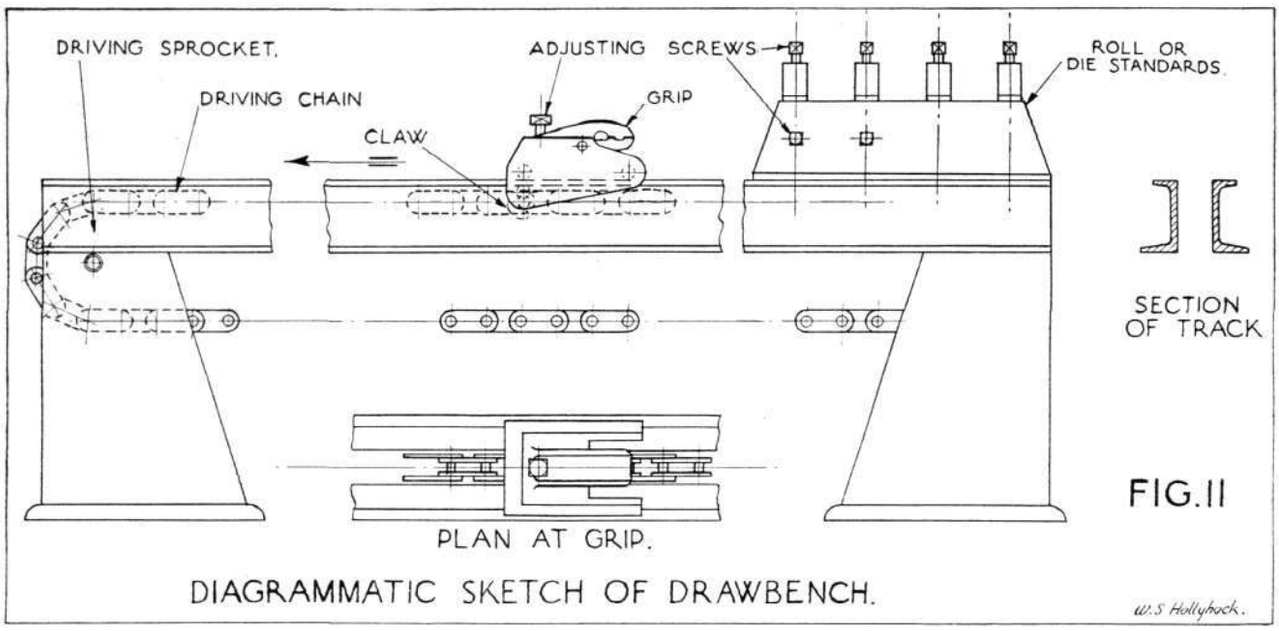
With regard to trueing up after wear has taken place, this process should not be overdone, as it is cheaper in the long run to make new rolls than to trim off excessively, as the latter results in poorly finished and inaccurate work.

One other point which may be deemed worthy of consideration, is the possibility (previously mentioned) of finishing a section with a die. This expedient may be excusable in the case of certain closed or elaborate sections, but the soundness of such a "mixed" policy is open to question. Dies so used are governed by the same considerations as apply to the design of drawbench dies.

Drawing.

The process of drawing is carried out on a drawbench such as is shown diagrammatically in Fig. 11 and which consists of a track, usually from 20 to 50 feet long, fitted with an endless driving chain. A claw on the grip drops into any one of the links of the chain and takes the pull. The grip, which runs in guides on the track, is attached directly to the end of the strip which is to be formed.

A clutch is fitted to the driving mechanism so that the work can be started or stopped instantly. If the clutch is of the "positive" type, some sort of shock absorbing device must be fitted to prevent snatch, otherwise the strip will probably tear or pull out of the grip.



At the end of the travel, the strip is disconnected from the grip and the formed length cut off. The grip is then disengaged from the chain by lifting out the claw and is run back—generally by hand—to the commencing end of the track and is then ready for drawing the next length of material.

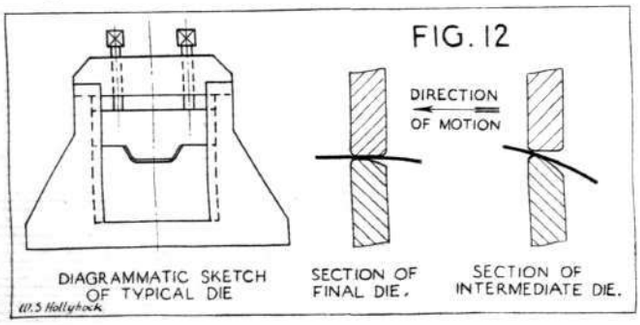
The speed of working should be approximately 10 feet per minute, though if variation is possible, 20 feet per minute is allowable (except at the start) under favourable conditions; *i.e.*, when the section is a simple one not requiring very severe working of the metal. This increase of speed is not very important, however, since the setting-up and man-handling time—which constitutes something like 50 per cent. of the total—will not be affected.

Drawing through Rolls.

This process is similar to rolling, in essentials. The rolls are designed in exactly the same way and the same general considerations govern the whole process.

One difference, however, is that since the rolls do not drive the work, it is necessary to apply power to them at the commencement until sufficient metal has passed through to enable the grip to be attached. With adequate gearing, man power is sufficient for this purpose. The gearing, by the way, should be disengaged during the travel so that the rolls can rotate freely at different speeds. This allows the slip to reduce automatically to a minimum and eliminates any tendency, in the case of very thin strip, to crumple between adjacent pairs or rolls.

Another difference between this process and ordinary rolling is the fact that the material being worked is constantly in tension. This definitely precludes the adoption of this method when complex sections are to be formed out of very thin strip. The working in such cases being so severe that the tensile load imposed is too great for the thin material. Even if it does not actually tear away or crack, distortion—and consequent weakening—is inevitable at those parts which are most heavily worked.



Drawing through Dies.

In this process the strip is drawn through slits in bar or plate dies which are set up in a vertical plane as shown in Fig. 12. The actual drawing operation is the same as drawing through rolls. The design of the dies does not differ greatly from the design of rolls as regards the shape of the strip and the number of dies required, but the following important considerations must be kept well in mind.

At the commencement of drawing, the strip must be laid into the dies and attached to the grip first. The upper and/or outer portions of the dies must then be fitted and the strip drawn through, a little at a time, the dies being tightened gradually while doing so.

It will therefore be realised that the design of the dies needs very careful consideration if this section is at all complex, particularly if it is a closed one. It is impossible to lay down any hard and fast rules on this subject, as every case must be treated on its merits. It is quite obvious, however, that the dies will sometimes have to be in several pieces, the tightening up being effected partly at the top and partly at the sides instead of from the top only as in the case of rolls.

Another point, which is of vital importance, is that the dies must be absolutely rigid when in use. The reasons for this, of course, are obvious.

Also, a good lead-in (as shown in Fig. 13) is essential; as, unlike rolling, in all cases and at all times the strip is being rubbed on practically the whole of its surface by the dies. For the same reason it is also necessary to have a really smooth finish on the dies.

The number and thickness of the dies and the lead-in are all interconnected. The absolute minimum number will, naturally, be governed by consideration of the material to be worked and the shape of the finished section; but if the material of the dies is thin, the lead-in will be correspondingly poor and the number of dies required to avoid scoring and stretching of the strip will consequently be greater. Generally speaking, the thickness should not be less than $\frac{3}{8}$ in. Incidentally, a thick die makes for rigidity, but excessive thickness increases the wear on the strip and also, by increasing the frictional losses, increases the power required to operate the drawbench.

The most satisfactory material for the dies will, as in rolling, depend upon the class of work to be done and the material to be worked. Since the mass of metal is not great, hardening does not present any great difficulty and therefore case-hardened mild steel may be employed in many cases with advantage, on account of its cheapness and easy working qualities. It is not,

of course, so lasting as tool steel, and dies made of it should be carefully watched and replaced at the first sign of wear.

General Remarks.

Tolerances.

Adequate allowance should always be made for variations in both width and thickness of strip.

Lubrication.

For rolling steel or drawing it through rolls, a light oil should be used. For drawing through dies a moderately heavy oil is better.

Aluminium and Duralumin may be worked dry in rolls both on the mill and the drawbench, but paraffin will be found to improve the working of Duralumin. For drawing through dies, paraffin should be used for both metals.

Bend Radii.

In Table II will be found a list of maximum and minimum bend radii for various materials. The minimum values are governed by the tendency to crack in working, and the maximum by crumpling failure under load in service. For non-structural work, the latter, naturally, do not apply.

TABLE II

Minimum and Maximum Bend Radii for Various Materials Given in terms of the Thickness

R = Inside Radius of Bend.
t = Thickness of Metal.

Material	R/t	
	Minimum	Maximum
H.T. Alloy Steel	2	30
Mild Steel, thinner than 14 G....	1	30
Mild Steel, 14 G and Thicker ...	1½	35
H.T. Stainless Steel	2	20
L.T. Stainless Steel	1½	30
Duralumin Thinner than 14 G....	2	20
Duralumin 14 G and Thicker ...	2	30
Aluminium	1	—

APPLICATIONS OF THE POLAR DIAGRAM

By E. H. ATKIN,* B.Sc.(Lond.)

BY far the most important practical addition to the methods of stressing aircraft structures introduced within the last four or five years is the method of the polar diagram.(1)

By its aid the strength of beams under compressive end load, which have concentrated loads, changes of distributed load in the bay, and changes of moment of inertia in the bay, can be determined with a speed and facility undreamed of under the old analytical method.

Where the booms of aeroplane spars are graded according to the bending moments imposed upon them, alternative arrangements of strengthening pieces can be investigated in a fraction of the time previously required. Indeed the labour of the old analytical method was so great that the time required for such an investigation was prohibitive. But in spite of the obvious superiority of the polar diagram, its power and possibilities do not appear to be as widely appreciated as they should be. Many people seem to think there is something mysterious, something occult, about what rests, as a matter of fact, upon a very simple recognisance. This simplicity of principle is, of course, common to many other elegant methods of geometry and analysis.

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The polar diagram is based on the fact that the solution of the general differential equation of a beam under lateral load and compressive end load can be looked upon as the polar equation to a circle passing through the pole.

As this equation will be useful for a certain purpose later on it will be well to give it here, together with its solution.

The equation is

$$\frac{d^2M}{dx^2} + \mu^2 M = w \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

and the solution

$$M = A \sin \mu x + B \cos \mu x + \frac{w}{\mu^2}$$

or alternatively

$$M - \frac{w}{\mu^2} = C (\cos \mu x - \varepsilon) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Where A and B, or C and ε are constants of integration.

It will also be useful to note that the true shear S is given by

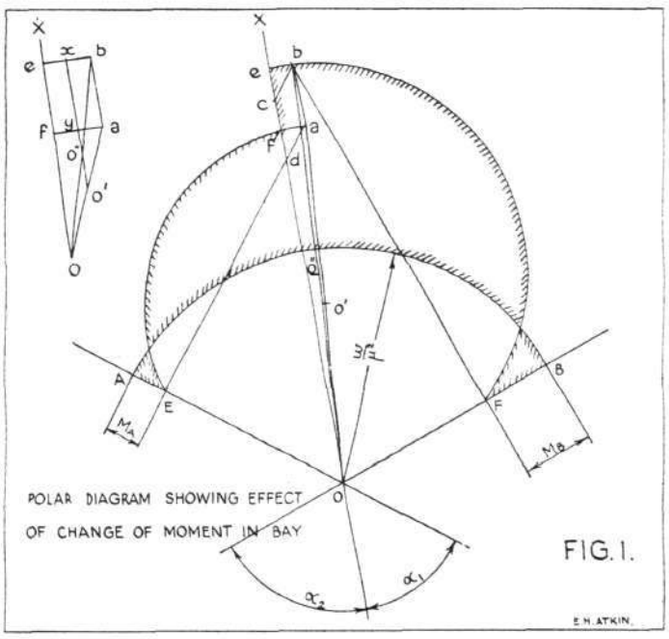
$$S = \frac{dM}{dx} = - \mu C \sin (\mu x - \varepsilon) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

The notation and sign conventions used here will be those generally accepted.(2) For any symbols and conventions special to the polar diagram reference should be made to the original report. It is also assumed in the following sections that the reader has acquainted himself with the main geometrical constructions of the polar diagram.

(1) Change of Moment in a Bay

While designing spars for a biplane one is sometimes faced with the problem of allowing for a change of moment away from a point of support. This can arise by reason of the local stiffening of one flange of a spar. In some cases the effect is considerable, and, as the stresses due to bending are usually increased thereby, its neglect will lead to optimistic reserve factors. Take, for example, the case in which the insertion of a liner in the compression boom of a spar doubles its effective gauge. If the centres of area of the booms are 6 in. apart, the introduction of the liner will move the neutral axis of the spar an inch towards the compression boom—a considerable offset for an average spar with end load.

The polar diagram enables us to allow for this in the simplest possible manner.



Referring to Fig. 1 we have the case of a beam with a change of moment in the bay. In general this is accompanied by a change in the moment of inertia of the section, but, to avoid confusing the two constructions, the diagram assumes that the moment of inertia is constant throughout the span. Once the construction of Fig. 1 is mastered no difficulty

in combining it with the construction of R. & M. 1233 should be experienced.

The beam A B is divided at X, the point of moment change, into two lengths a_1 and a_2.

By aid of the formulæ

$$\alpha_1 = a_1 \sqrt{\frac{P}{EI}} = a_1\mu$$

$$\alpha_2 = a_2 \sqrt{\frac{P}{EI}} = a_2\mu$$

$$OA = OB = \frac{w}{\mu^2}$$

the known moment of inertia I and end load P enable us to calculate the angles of α_1 and α_2 for the parts a_1 and a_2 respectively.

Commence drawing the diagram in the usual manner. Assume the moment change ΔM_x at OX is dc to the moment scale of the diagram.

Through c draw cb parallel to Ed to meet Fb in b, and through b draw ab parallel to OX.

Then b is the apex for the part a_2 and a is the apex for part a_1.

Proof.

The physical requirements of the problem are :—

(1) No change of shear at OX

(2) Moment Change $\Delta M_x = ef$

(1) Is satisfied by the construction. It therefore remains to prove that

$ef = cd = ab = \Delta M_x$

$cd = ab$ by obvious construction.

Referring now to the exaggerated sketch in the top left-hand corner of Fig. 1, in which the lines and letters correspond exactly with the main diagram.

O″ and o' are the centres of the circles OeF and OEf.

Hence Ob and Oa are bisected at o'' and o'; therefore o'' o' is parallel to OX, and ab, and bisects the perpendiculars from a and b to OX in x and y.

It follows, therefore, that circles on oa and ob as diameters will pass through f and e respectively.

That is to say, our construction is such that

$ef = ab = cd =$ Moment Change ΔM_x.

The apices are, therefore, displaced relatively to each other as in the case of change of lateral load.

(2) Shear Deflection

In many types of Strip Steel Spars, the shear distortion has an appreciable effect on the bending moment.

This is due, of course, to the interaction between the added deflection due to shear and the end load, and results in a greater end load bending moment.

It is quite usual for the total bending moment to be increased 7 or 8 per cent. by virtue of the shear deflection.

The effect of shear distortion is, therefore, usually allowed for in design by the introduction into the calculations of an experimental constant r defined by the relationship

$$\frac{dy_s}{dx} = -rS$$

where y_s is the deflection due to shear and S the true shear.

From this definition and the general beam theory, it may be proved (3) that

$$\frac{d^2M}{dx^2} + \frac{\mu^2}{1 - rP} M = \frac{w}{1 - rP} \quad \ldots\ldots\ldots \quad (4)$$

But this equation is of exactly the same form as equation (1), on which the theory of the polar diagram is based.

If, therefore, we replace

$$\mu^2 \text{ by } \mu_1{}^2 = \frac{\mu^2}{1 - rP} \text{ and } w \text{ by } w^1 = \frac{w}{1 - rP}$$

the polar diagram (with a negligible amount of extra work) for a single bay allows for shear distortion. Further, the true shear can be obtained from the diagram in the normal manner, *i.e.*, in Fig. 1.

$$\text{Shear at end A} = Ea \,.\, \mu_1 = Ea \,.\, \frac{\mu}{\sqrt{1 - rP}}$$

However many changes of section there may be in one bay, knowing r for each section, the diagram can be drawn.

A word of warning may be well here.

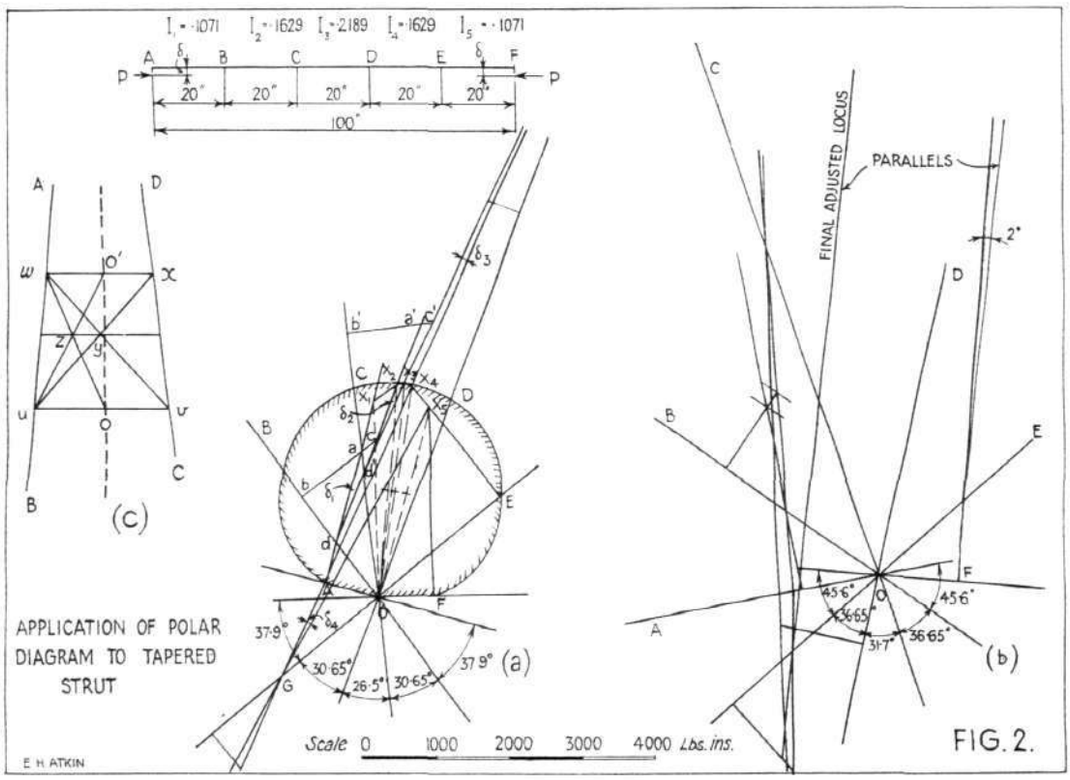


FIG. 2.

The formulæ for continuous beams cannot be modified by this artifice alone because it is not valid to equate total slopes on each side of a support.

The parts of the slopes on either side of a joint due to bending alone must be expressed separately and equated.(4)

(3) Struts of Varying Cross-Section

The mathematical analysis of the tapered strut has occupied many writers and much valuable work has been done on the

subject. Unfortunately, the calculations are usually very complicated, and the results are applicable only to compression members with specific types of taper. It may be, too, that exigencies of manufacture preclude the use of a taper which is amenable to mathematical analysis. A general method of attack is, therefore, required which will lead to a solution whatever may be the type of taper used.

The polar diagram provides this method.

This can be best illustrated by an example.

Example.—To determine the bending moment at the centre of a tapered strut 100 in. long under an end load of 3,500 lb. The strut varies from 2 in. O/D 10 G at the centre to 2 in. O/D 20 G near the ends, and the moment of inertia of the strut varies linearly from the centre to the ends.

It is necessary to assume an eccentricity δ for the end load. δ may be calculated by the usual formula (5)

$$= \frac{1}{600} + \frac{d}{40}$$

whence $\delta = 0{\cdot}216$ in.

and the moments at the ends are therefore

$$0{\cdot}216 \times 3{,}500 = 756\ lb.\text{-}in.$$

Next divide the strut into lengths over each of which the moment of inertia may be considered constant. This has been done and the values given for each 20 in. in Fig. 2.

The data requisite for drawing the diagram may now be tabulated :—

Section	AB	BC	CD	DE	EF
P lb.	3,500	3,500	3,500	3,500	3,500
μ^2 in.$^{-2}$	0·001089	0·000717	0·000533	0·000717	0·001089
μ in.$^{-1}$	0·0331	0·0267	0·0231	0·0267	0·0331
a in.	20	20	20	20	20
$\alpha_\circ$	37·9°	30·65°	26·5°	30·65°	37·9°

The diagram, drawn according to the known rules is shown in Fig. 2A ; in this case, however, the actual details of the construction may be useful to those not already versed in this method.

First set out the lines OA, OB, OC, OD, OE, OF at the calculated angles apart.

On OA and OF make OA and OF equal to the end moments, and through A and F draw perpendiculars to OA and OF respectively.

Through any point b on the dividing line OB draw a perpendicular cutting the perpendicular from A in a : on ab take a point c such that

$$\frac{bc}{ab} = \frac{\mu AB}{\mu BC}$$

Join cd

The line cd is considered as line " ad adjusted."

To help in remembering whether ab is greater or less than bc, it should be noted that at any dividing line where we pass to a stiffer part of a beam, or strut, the adjustment always increases the angle, *e.g.*, $\angle\ bdc > \angle\ bda$.

Coming to the dividing line OC we adjust dc in the same manner and obtain the adjusted line d^1c^1.

The same construction is performed at OD and OE ; in these cases note that we are passing to a more flexible part of the strut.

The final adjusted line at OE cuts the perpendicular at OF in X_5, one required apex.

Exactly the came construction is now performed starting at OF, and drawing the perpendicular to OE through X_5. In this way we obtain a new set of adjusted lines whose successive intersections are the required apices $X_4\ X_3\ X_2\ X_1$

$$e.g., \frac{EX_4}{EX_5} = \frac{\mu EF}{\mu DE}$$

On the lines OX_1, OX_2, OX_3, OX_4, OX_5 as diameters describe the arcs AB, BC, CD, DE, and EF ; then the length of the radius vector from O to any point on this composite curve is the moment at that point.

The maximum moment is 2,970 lb. in.

So that the stress can now be calculated.

Some readers may experience difficulty in joining a point to the meet of lines which converge to a point off the paper. An accurate method of doing this is shown in Fig. 2 C.

It is required to join O to the meet of AB and CD.

Through O draw any line uOv and draw wx parallel to it. Join wo, wv, ux, and through y draw xy parallel to wx.

The join of uz meets wx in a point O′ on the line joining O to the meet of AB and CD.

After a little consideration the reader will have no difficulty in convincing himself of the correctness of this construction.

(4) The Euler Instability Angle

The example of Section (3) will now be used to extend the well-known idea of the Euler failing load of a strut.

According to the theory of the ideal strut, the equation

$$P = \frac{2EI}{L^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

defines the Euler failing load of the strut.

This equation may be thrown into the form

$$= L\sqrt{\frac{P}{EI}}$$

But $\sqrt{\frac{P}{EI}}$ is the quantity already denoted by the symbol μ

and μl is the angle α between the extreme lines on the polar diagram.

Hence we infer that any member under compressive end load tends to instability ; as α approaches ∞ however, it may be loaded laterally, provided that its moment of inertia is constant throughout its length. This follows immediately from the polar diagram because as $\alpha \to \pi$ all apices move to infinity. We therefore call π the *instability angle* of the member.

Many people appear to think that π is the universal instability angle, whether the member is of constant section or not.

It is now proposed to show that this is not true, and to indicate how the true instability angle may be determined.

At the same time it will be seen more clearly how the polar diagram takes account of the *position* of stiffened parts of a member.

Referring again to Fig. 2 (*a*) we have already called the $\angle\ adc$ the adjustment of the line ad.

Having denoted the successive adjustments by δ_1, δ_2, δ_3 and δ_4 we may express the angle between the finally adjusted locus GX_5 and FX_5 by the formula

$$\beta + \delta_1 + \delta_2 + \delta_3 + \delta_4 \text{ or } \beta + \Sigma\ \delta$$

where β is the supplement of the sum of the angles αAB, αBC etc.

i.e., $\beta = \pi - (\alpha AB + \alpha BC + \text{etc.})$ or $\pi - \Sigma\alpha$

Now instability is indicated when $\angle\ GX_5\ F$ tends to zero.

That is to say when $\beta + \Sigma\delta$ tends to zero. But although $\Sigma\alpha$ is only 16·4° less than 180°, $\beta + \Sigma\delta$ equals 31° therefore the probable value of $\Sigma\alpha$ at instability is about 194°.

Let us now increase our loads until $\Sigma\alpha = 195{\cdot}6°$

The following are the increased values.

$$\alpha AB = \alpha EF = 37{\cdot}9° \times \frac{195{\cdot}6°}{163{\cdot}6°} = 45{\cdot}6°$$

$$\alpha BC = \alpha DE = 30{\cdot}65° \times \frac{195{\cdot}6°}{163{\cdot}6°} = 36{\cdot}65°$$

$$\alpha CD = 26{\cdot}5° \times \frac{195{\cdot}6°}{163{\cdot}6°} = 31{\cdot}7°$$

$$\text{Bending moment} = 756 \times \left(\frac{195{\cdot}6}{163{\cdot}6}\right)^2 = 1{,}080\ lb.\ in.$$

The new diagram is shown in outline in Fig. 2 (*b*). Evidently we are still 2° away from the instability angle, but a first correction reduces the angle so effectively that we are justified in adding directly the remaining difference of 2°

and saying that the result gives the instability angle, which is 197·6°. This may be called the *Modified Euler instability angle.*

A simple, but instructive, example will now be given showing the effect of the position of stiffening on the strength and the instability angles of two struts of the same weight. Everyone knows, in a vague way, that a strut stiffened in the centre is stronger than a strut with the same length of stiffening, but placed at the ends. This example will, it is hoped, bring out the differences between the two arrangements.

(To be continued.)

REFERENCES

(1) Aeronautical Research Committee, R. & M. No. 1233.
(2) *l.c.*, p. 29.
(3) Air Ministry Publication No. 970, Appendix No. IB.
(4) *l.c.*
(5) Air Ministry Publication No. 970, Appendix No. VII.
(6) R. & M. No. 1233, Fig. 14.

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any Bookseller.

SPINNING EXPERIMENTS ON A SINGLE-SEATER FIGHTER WITH DEEPENED BODY AND RAISED TAILPLATE. PART I. MODEL EXPERIMENTS. By H. B. Irving, B.Sc., and A. S. Batson, B.Sc. PART II. FULL-SCALE SPINNING TESTS. By A. V. Stephens, B.A. R. & M. No. 1421. (16 pages and 21 diagrams.) December, 1931. Price 1s. 3d. net.

In its original form the single-seater fighter which is the subject of this report spun rather flat and very fast, and recovery was extremely difficult if delayed beyond a very few turns. Model experiments were made on this form both in the wind tunnel* and by free-flight dropping tests†, followed later by a cautious exploration of the spin of the full scale aeroplane‡ in which it was found that the incidence attained an angle approaching 60°, the time of turn being about 1·2 seconds. These experiments were discontinued after two such spins, in which 40 and 34 turns were made before recovery.

The next stage was the modification of the fighter by lengthening the body, and at the same time considerably increasing the fin and rudder areas and placing the tailplane on top of the body. Model and full-scale experiments on such modifications are described in R. & M. 1278§. The full-scale experiments showed that recovery was very greatly improved but was slow, three to four turns being required.

The present report describes model and full-scale experiments in which, keeping to the original length of body and the original rudder, the body was deepened above and below and the tailplane raised nearly to the top of the rudder. On the full-scale the deepening was effected by adding fin area above and below the body.

The model work includes rolling and sideslip experiments together with measurement of pitching moment on the model with raised tail. In the full-scale experiments, rate of turn and normal acceleration at the centre of gravity were measured for various conditions of centre of gravity, petrol load and elevator position. The effect of applying full engine was also examined.

The general conclusion reached is that deepening the body and raising the tailplane have entirely eliminated the vicious spinning properties of the original aeroplane. Rapid recovery from all spins can be made and the pilots are of opinion that the good qualities of the original machine both in aerobatics and in normal flight are not only maintained but enhanced.

* R. & M. 1184. Experiments on a model of a single seater fighter in connection with spinning.—Irving and Batson.

† R. & M. 1404. Free flight spinning experiments with several models.—A. V. Stephens.

‡ R. & M. 1403.—Measured spins on aeroplane—H. Gates.

§ R. & M. 1278.—Spinning experiments on a single-seater fighter. Part I. Further model experiments.—Batson and Irving. Part II. Full-scale spinning tests.—Gates.

WIND TUNNEL TESTS ON AILERON LOADS. By F. B. Bradfield, Math. & Nat. Sci. Triposes, G. F. Midwood and F. R. C. Hounsfield. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1443. (20 pages and 25 diagrams.) September, 1931. Price 1s. 3d. net.

The purpose of investigation was to provide data on which to base revised strength requirements for allerons.

Force normal to the aileron has been measured on aerofoils of R.A.F. 28 and R.A.F. 34 section, and on R.A.F. 34 section slotted all along the span and at the tips only. The ailerons were balanced and unbalanced. The types of balance, and degree of balance have been varied, as also the span and chord of the aileron. Aileron angles of from ± 40° have been tested at angles of incidence corresponding to high-speed and stall. The centre of pressure of the force is given. In addition, the force on the main wing ahead of the aileron has been measured at various positions along the span with unbalanced and slotted ailerons. The centre of pressure of this force was measured.

Of the total change in load due to moving the ailerons, roughly 40 per cent. is carried on the aileron, and 60 per cent. on the main wing. An exception to this occurs with the slotted aileron at negative angles of incidence greater than 10°; in this case the load on the aileron becomes steadily more negative as the aileron is pulled up, whereas the load on the main wing remains constant.

This method of testing the force on a section of the wing seems satisfactory for obtaining quick results of this type. The results can be obtained much more rapidly than by pressure plotting.

THRUST INTEGRATING TUBES, WIND TUNNEL EXPERIMENTS. By C. N. H. Lock, M.A., F. C. Johansen, M.Sc., and H. L. Nixon. R. & M. No. 1447. (22 pages and 10 diagrams.) August, 1931. Price 1s. 3d.

A series of wind-tunnel experiments has been carried out in order to investigate the characteristics of thrust integrating tubes of similar design to that used as a zero thrust indicator during the full-scale trials of the Blackburn "Iris" seaplane, described in R. & M. 1354.*

As a means of estimating the possibilities of such an instrument over a range of values of thrust, tests have been made on exact and modified small scale models of the "Iris" tube, in conjunction with a 19½-in. diameter model airscrew, for which thrust grading and force measurements were available from an earlier research (R. & M. 1380†). A number of auxiliary experiments have also been undertaken to elucidate the mechanism of the thrust integrating tube, and to reveal any influences of scale-effect, as between model and full-size instruments, in qualifying the conclusions drawn from model tests. Such auxiliary work includes "shielding" experiments on models and on actual full-scale tubes, in which an artificial variation of pressure was produced by a movable shield; and "flowmeter" experiments, in which the rate of flow of air through the holes of a simplified form of thrust integrating tube was measured by an orifice meter.

The present experiments have revealed certain general considerations affecting the design of thrust integrating tubes, which may be summarised as follows:—

(1) When the apertures in the tube are simply circular orifices, the diameter of such orifices should not exceed one quarter the bore of the tube; otherwise the pressure gradient along the tube will not be negligible.

(2) The orifice type of tube is sensitive to orientation about its axis, but its indications of thrust should be sufficiently accurate over the normal working range, excluding the "static" condition, but including zero thrust, if the holes are inclined at about 5 deg. into the direction of rotation of the slipstream. This defect may be avoided by substituting short projecting "pitot" tubes for the plain orifices.

(3) The integrating tube should not be mounted in front of any considerable obstruction, such as a radiator, situated close behind the airscrew and occupying only a small part of the circumference.

At zero thrust, the model tests show that small variations in the radial spacing of the holes in the integrating tube are not of much importance. At other values of thrust, the model tests suggest that the integrating tube could be used with reasonable accuracy.

* R. & M. 1354. Full scale measurements of lift and drag af large seaplanes. Experiments on Blackburn "Iris."—Coombes & Cushing.

† R. & M. 1380. Pressure and force measurements on airscrew-body combinations.—Bateman & Johansen.

TESTS OF ANCHORS FOR USE ON FLYING-BOATS. By L. P. Coombes, B.Sc., and the Experimental Staff of the Marine Aircraft Experimental Establishment, Felixstowe. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1449. (14 pages and 14 diagrams.) May, 1931. Price 1s. 3d. net.

A great deal of experimental work on anchors for seaplanes was done at Felixstowe several years ago. A large proportion of the work was devoted to the production of a suitable Service anchor, and the Felixstowe Mark XIIA anchor was the result of this work. The increasing size of flying boats has once more brought forward the problem of anchors, and the present investigation was therefore commenced, which led to the following conclusions.

(1) Model anchor tests, if done under suitable conditions, give results from which the drag of a full-scale anchor can be predicted.

(2) The drag of an anchor is primarily dependent on its shape and very little on its weight.

(3) Weighting the anchor line by means of chain cable or with concentrated weights is of little value in increasing the holding force under steady conditions.

(4) The holding force of an anchor decreases rapidly as the angle of the cable to the horizontal is increased, and anchors are very inefficient at cable angles greater than 20°. A length of cable not less than 3½ times the depth of water should be regarded as the minimum length, and this should be increased whenever circumstances permit.

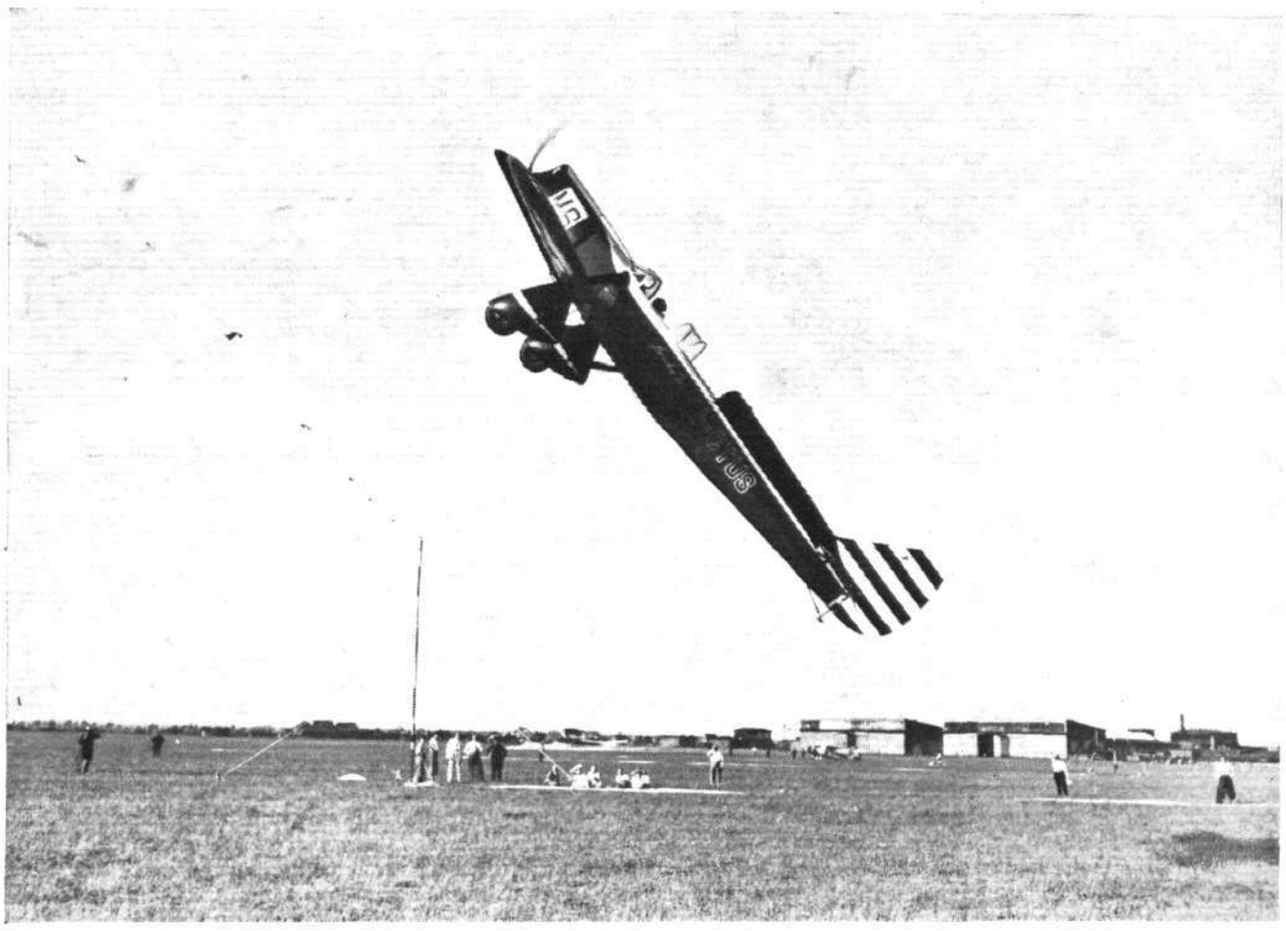
(5) Anchors with stocks are much more efficient than stockless anchors, which are generally unstable.

(6) The holding force o fthe Felixstowe Mark XIIA anchor is increased from about 800 lb., to about 1,000 lb., by increasing the linear dimensions of the flukes 25 per cent.

MEASUREMENT OF TAKE-OFF AND LANDING RUNS. By D. Rolinson, M.Eng. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1458. (3 pages and 2 diagrams.) November, 1931. Price 4d. net.

In determining lift coefficients of an aircraft taking off or landing, the value of wind velocity assumed introduces a possible error. The precise value at the instant of take-off is not known, and a mean figure for the average wind during the run has been used. Under-estimation of wind speed leads to over-estimation of lift coefficient. It was suggested, therefore, that a landing and take-off down wind should be photographed. In this case, the assumption that the wind speed was zero would correspond to a minimum value of lift coefficient. It was also hoped that some light would be shed on the high value of rate of climb ascribed to wind gradient.

A Wapiti aircraft was taken off and landed down wind, the runs being photographed with the panoramic camera. The down wind values of lift coefficient were of the same order as values obtained for normal take-off and landing. The most marked difference between the down wind and up wind runs was in the distance to clear a given height.



"THAT'S A BREDA 33 THAT WAS": Lombardi taking his fences in great style.

THE INTERNATIONAL TOURING COMPETITION

By EDWIN P. A. HEINZE

FAVOURED by excellent weather, the technical tests preceding the European air tour and final speed test of the *Challenge de Tourisme International* began at Berlin-Staaken airport on August 12. By noon of the previous day 41 machines had come in for the trials. Two more competitors availed themselves of the right to compete by paying double fees and coming later, the absolutely last minute for arrival being 4 o'clock of the afternoon of August 12. The original number of 67 entries had thus dwindled down to 43.

Of the original 32 German entries, only 16 were left, these consisting of seven new three-seater "Klemms," six two-seater "Heinkels," an American "Monocoupé 110," and one of the only two biplanes in the contest, the machine built by students of the Darmstadt College of Engineering (Akaflieg).

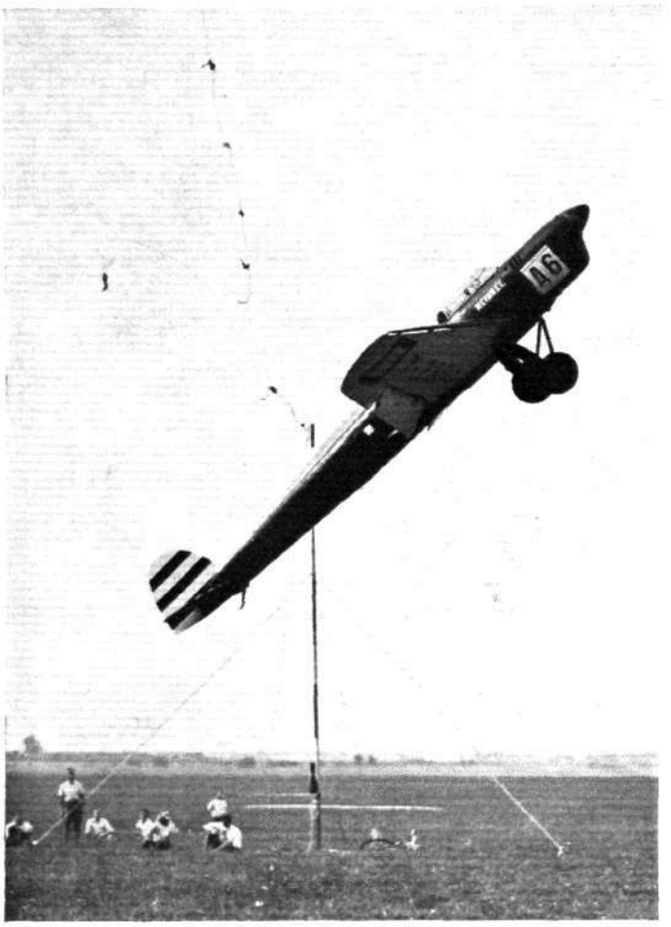
Among the German machines that have been withdrawn from the competition are, unfortunately, some very interesting new designs, to which reference was made last week.

On the French side, two Marcel Bloch, a Caudron "Luciole," and a Mauboussin were withdrawn, while the Italians turned out complete with Miss Spooner, as also did the two Swiss competitors. The Poles scrapped one entry, an RWD-6, and the Czecho-Slovakians three entries.

The demand for greater speed set by this year's regulations has practically ousted the second category of light planes, of which a large number still took part in the last competition, held in 1930. Considerable concessions had been made relative to the permissible weight of the machines, by which they are classified. According to the original regulations, the machines of the first category were to weigh empty not more than 400 kg. (880 lb.) and those of the second category not more than 280 kg. (616 lb.). But already in 1930 it was found necessary to make an allowance of 15 per cent., and this year it has been raised to 20 per cent., so that in effect the first category machines are allowed to weigh 480 kg. (1,056 lb.) and the second 336 kg. (739 lb.). But even this could not save the small machines, for the minimum speed required on the Circuit of Europe has been raised since 1930 from 60 to 100 km./hr. (62 m.p.h.) on the average. The minimum touring (average) speed of the first category of machines has been raised from 80 to 125 km./hr. (77.7 m.p.h.).

These increased speed requirements have in the first place, of course, to be met by engine designers, and particularly good development work in this direction has been effected by German engineers, who, during the last three years, have succeeded in ousting altogether non-German engines in their country. The Argus and Siemens engines, already conspicuous in the two previous contests, have been improved considerably and a new make, the Hirth, made its début last year during the German Light Plane Contest. The seven-cylinder Siemens radial engine, which in 1930 developed 110 h.p. with a weight of 1.32 kilogrammes per h.p. output, now delivers 150 h.p. with a compression ratio of 5.3 to 1 and 160 h.p. with one of 6.2 to 1. The h.p. weight has come down to 0.83 and 0.78 kg./h.p. The inverted four-cylinder Argus, once developing 110 to 120 h.p., now gives 150 and 160 h.p. Last year's inverted four-cylinder Hirth engine was brought out in April last with two rows of four cylinders arranged in an inverted Vee, and developing 150 h.p. This engine works particularly smoothly owing to its having eight cylinders.

The very neat six-cylinder Colombo engine of the Italians has likewise benefited by improvements. A large



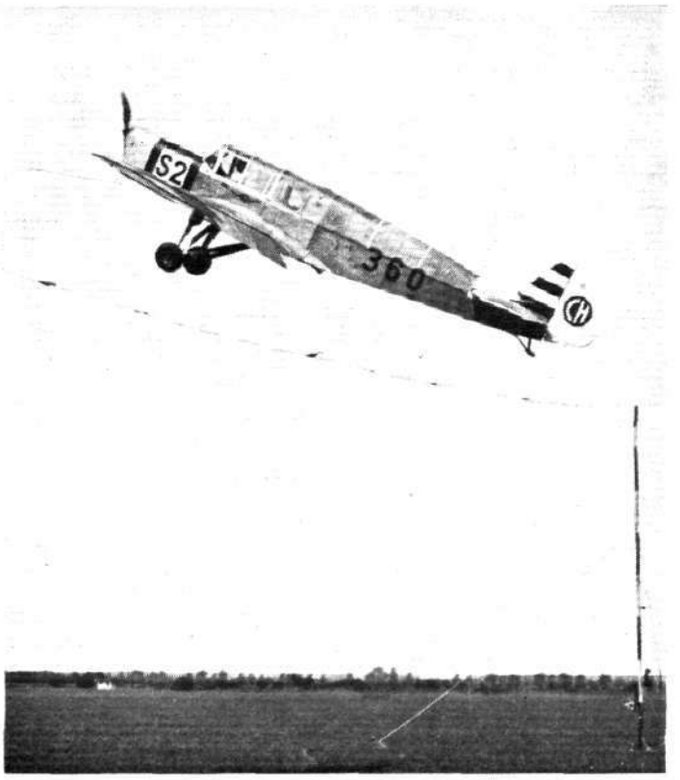
A GOOD TRY : One of the Heinkel (Argus) monoplanes, piloted by von Massenbach, breaks the tape in a take-off test.

number of Gipsy III engines is being used in this year's contest. Miss Spooner had one fitted in her Breda-33 and has performed excellently with it, especially in the landing and starting tests over the 8-m. obstacle. The Polish PZL low-wing monoplanes are likewise equipped with Gipsy III engines, which are also found on the Czecho-Slovakian Praga B.-H. 111 low-wing monoplanes, on a French Farman, a German Heinkel, the two Swiss entries (a shoulder-wing Comte monoplane and a new "Klemm"). The two Polish RWD-6 shoulder-wing cabin planes have Genet-Major engines with Townend rings. On the whole, the competing planes are more or less all fitted with engines of at least comparable power output, so that the results of this competition will be influenced more extensively than usual by the qualities of the machines and pilots. Only the French planes are somewhat low-powered. The Guerchais has a 100-h.p. Renault; the two exceedingly attractive Potez have six-cylinder radial Potez engines (with Stromberg carburetters) of 100 h.p. output. The Caudron biplane alone has an engine comparable with that of the Italian, Polish and German competitors. It has a seven-cylinder radial Salmson of 135 h.p. output. The Farmans of Arnoux and Puget have 95-h.p. Salmson engines. Nicolle's small Mauboussin, the only second-category competitor, has only a 40-h.p. Salmson engine.

Turning to other technical features one finds that metal variable pitch propellers are being used practically by all competitors. Interesting also is the extensive use made of wing flaps between the ailerons and fuselages. This is a beneficial result of the regulation which provides special points in the equipment rating for the provision of devices preventing stalling and which requires the machines to have a low landing speed coupled with a fast touring speed. The various slot arrangements adopted in some cases together with these flaps have achieved remarkable successes. Machines travelling normally at far over 200 kilometres per hour have actually travelled between 60 and 70 kilometres per hour without losing altitude during the slow flying test! Notable is also the extensive use of Palmer wheels and brakes. Also the tailplane surfaces are in almost all machines adjustable from the pilot's seat during flight. In some cases not only these but also the rudder fins are so adjustable, while in the new Klemms the ailerons are adjustable together with the slow-speed wing flaps, so continuity of surface between these is ensured in whatever position the wing flaps are locked.

The equipment rating was the first to be carried through. Since it provides for no less than 107 points out of a total of 500, this rating is a very important item and, indeed, it has marred the chances of a large number of competitors, who doubtless thought they would come off much better than they did. The International Committee had a very difficult task in arriving at correct verdicts, as will easily be understood by a consideration of the items for which points had to be awarded:—

(1)	Visibility from pilot's seat ... ... up to	13 points.
	Visibility from observer's seat ... up to	5 ,,
	(If cabin can be opened during flight visibility is tested both in closed and open condition.)	
(2)	Safety devices for flying:	
	(*a*) New devices for preventing stalling (such as slotted ailerons, etc.) and especially means for altering the gliding angle	10 ,,
	(*b*) Heavy oil engine	10 ,,
(3)	Means for altering the trim of the machine other than by means of shifting weights:	
	During flight	9 ,,
	On ground	2 ,,
(4)	Good arrangement of instruments ...	8 ,,
(5)	Metal fuselage (fuselage frame)	5 ,,
(6)	General comfort (perpendicularly and horizontally adjustable seats, adjustable control sticks, arm rests, upholstered seat backs, easy reach of all controls, etc.) ...	12 ,,
(7)	Cabin for the whole crew	8 ,,
(8)	Escape means (provision for easily leaving the machine in an emergency)	5 ,,
(9)	Seats side by side	5 ,,
(10)	Third comfortable seat, which need not be occupied during the contest	4 ,,
(11)	Fire prevention devices other than those specified as normal requirement (fully automatic extinguishers, reliable fire indicators, etc.)	3 ,,
(12)	Landing gear (divided axle, hydraulic springs)	4 ,,
(13)	Wheel brakes	2 ,,
(14)	Double controls (one set lockable from pilot's seat)	2 ,,
	Total	107 points.



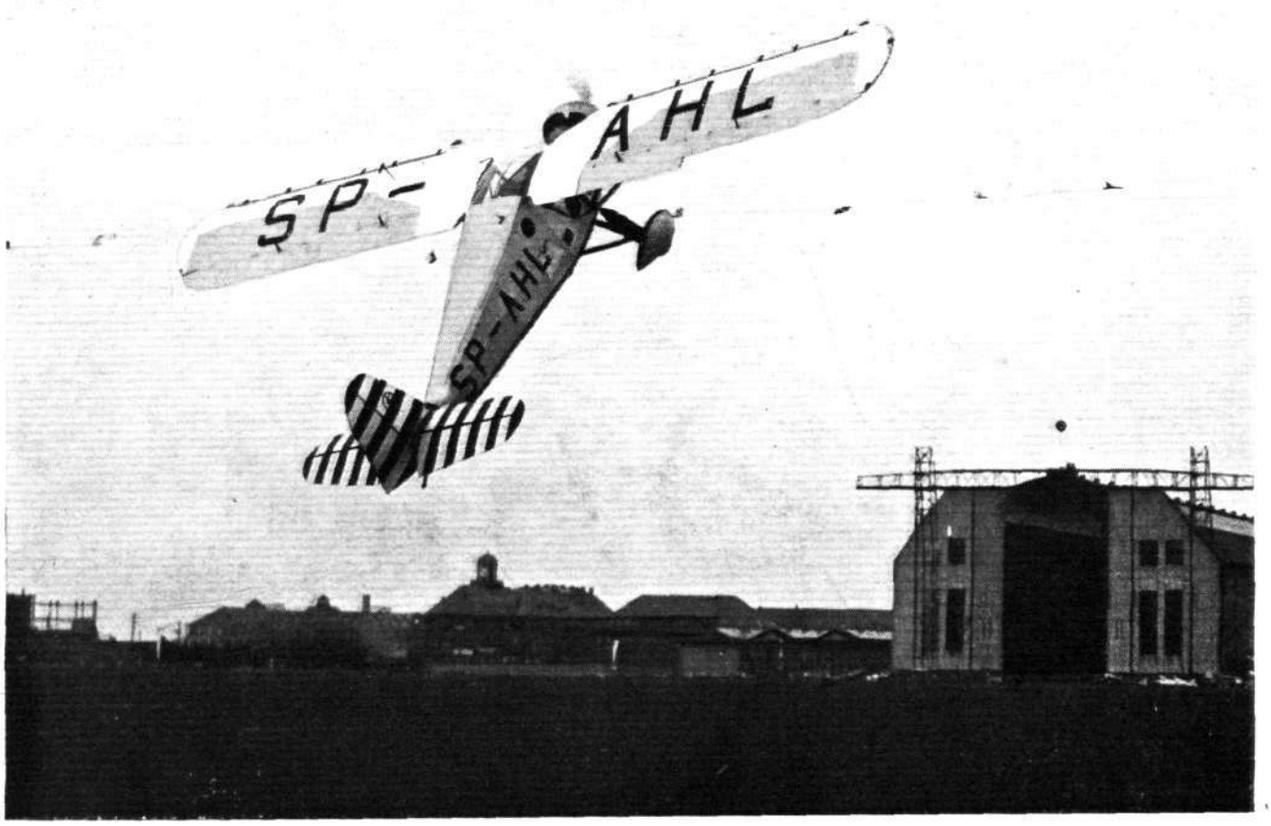
SWITZERLAND, TOO : A Klemm (Gipsy III) piloted by Fretz gets good marks in the take-off, without turning helicopter.

INTERNATIONAL TOURING COMPETITION

Results of Technical Tests

Position	Pilot	Machine	Engine	h.p.	Points awarded in the individual Ratings: Equipment	Slow-flying	Dismantling for Transport and re-erecting	Engine Starting	Take-off	Landing	Fuel Consumption	Total Number of Points
1	Colombo	Breda 3	Colombo	130	83	50	6	5	40	38	25	247
2	Zwirko	RWD 6	Genet-Major	140	86	50	6	5	37	38	23	245
3	Lombardi	Breda 33	Colombo	130	83	50	5	5	40	34	25	242
4	Miss Spooner	"	Gipsy III	120	83	50	5	3	35	40	25	241
5	Donati	"	Colombo	130	83	48	6	3	38	37	26	241
6	Stoppani	"	"	130	83	48	6	5	37	34	25	238
7	Karpinski	RWD 6	Genet-Major	140	86	50	6	5	37	29	25	238
8	Suster	Breda 33	Colombo	130	83	48	5	5	38	32	24	235
9	Poss	Klemm KL 32	Argus	140	72	42	7	4	39	40	30	234
10	Fretz	" "	Gipsy III	120	72	44	6	5	39	38	27	231
11	W. Hirth	" "	Hirth	150	71	44	7	4	40	37	27	230
12	Junck	Heinkel HE 64	Argus	140	66	50	6	5	32	36	30	225
13	Morzik	" "	"	140	66	48	6	5	35	34	30	224
14	Cuno	Klemm KL 32	Siemens	135	71	42	6	6	38	31	30	224
15	Bajan	PZL XIX	Gipsy III	120	84	40	6	5	34	29	25	223
16	Stein	Heinkel HE 64	Argus	140	66	44	7	5	36	33	30	221
17	de Angeli	Breda 33	Colombo	130	83	46	6	5	37	19	24	220
18	Pasewaldt	Klemm KL 32	Siemens	135	71	40	6	6	38	31	27	219
19	Lusser	" "	Argus	140	72	40	7	5	38	28	29	219
20	Osterkamp	" "	"	140	72	38	6	5	38	30	30	219
21	Viazzo	Breda 33	Colombo	130	83	22	5	4	38	39	25	216
22	Seidemann	Heinkel HE 64	Argus	140	66	50	7	4	30	28	29	214
23	von Cramon	" "	"	140	66	44	6	4	32	31	29	212
24	Giedgowd	PZL XIX	Gipsy III	120	84	24	6	3	34	22	25	198
25	Kleps	Praga BH 111	"	120	80	22	6	5	28	28	27	196
26	Delmotte	Caudron " Luciole "	Salmson	135	44	48	6	6	34	28	26	192
27	Kalla	Praga BH 111	Gipsy III	120	80	22	6	5	27	24	28	192
28	von Massenbach	Heinkel HE 64	Argus	140	66	48	6	3	0	30	30	183
29	Mares	Praga BH 111	Gipsy III	120	80	24	6	5	30	9	29	183
30	Détré	Potez 43	Potez	100	66	38	−15	6	26	39	18	178
31	Durovon	"	"	100	66	32	−15	6	28	35	19	171
32	Orlinski	PZL XIX	Gipsy III	120	84	30	6	4	0	22	25	171
33	Papana	Monocoupe	Warner-Scarab	110	58	14	−15	6	32	28	27	150
34	Massot	Guerchais T 9	Renault	100	69	16	0	6	21	15	20	147
35	Marienfeld	Akaflieg	Argus	140	54	12	2	5	34	8	30	145
36	Anderle	Breda 15 S	Gipsy III	120	53	18	5	5	30	12	20	143
37	Straumann	A. Comte 12 E	"	120	60	0	−15	5	26	23	28	127
38	Nicolle	Mauboussin M 12*	Salmson	40	44	32	−15	4	3	18	25	111
39	Arnoux	Farman 234	"	95	46	10	−15	0	13	10	25	89
40	Lebeau	Farman 350	Gipsy III	120	46	0	−15	5	0	12	30	78
41	Raab	RK 25/32	Argus	120	45	0	−15	5	0	0	21	56

* The only competitor in the 2nd Category. Results subject to confirmation by Sports Committee.



THE HIGH JUMP : Karpinski, on one of the Polish RWD machines, nearly succeeds in getting his " Genet Major " engine to lift him vertically over the tape, which is caught on the " spats."

In this rating the two Polish RWD—6 shoulder monoplanes, with two seats abreast in cabin, as well as slow-speed flaps, were able to obtain 86 points, the highest number any competitor was able to collect. The other three Polish low-wing planes, with three seats each, were awarded 84 points each. The eight Italian Breda 33 were given 83 points each, while 80 points were allocated to the three Czecho-Slovakian Praga low-wing machines. Then followed the new Klemms with 72 and 71 points. The new Heinkels only managed to collect 66 points, and thus already at the beginning sustained a heavy setback. Massot's Guerchais booked 69 points. All the others ranged between 45 and 58 points.

In the test for the dismantling for transport and re-assembling for flight, for which 7 points could be allocated if completed within one minute, three Klemms and two Heinkels obtained full marks. The majority of the other machines had to be satisfied with 6 and 5 points, which indicates that their crews required 3 and 5 minutes respectively for the work. Only two persons were allowed to do this, and if they required more than 15 minutes they could either go without marks or have a second try, in which case they could gain half the normal number of points or, in the event of failing again, lose 15 points. No fewer than eight machines thus lost 15 points each from their previous sum, including the two Potez, the Monocoupé, the Swiss Comte, Arnoux's and Lebeau's Farmans and the German Raab's modernised old Raab-Katzenstein low-wing monoplane.

The full number of six points for efficient engine-starting appliances, and shortness of starting time, were awarded to Cuno's and Pasewaldt's Argus-engined Klemms only. The majority of other competitors obtained 5 and 4 points, while Arnoux's Farman failed altogether.

The low-speed test was very interesting. During this test, as also in the starting and landing, and fuel consumption tests which followed, each machine had to carry a minimum load of 200 kg. (440 lb.). What was missing on the weight of the crew on this had to be made up by ballast. Also, the second controls, if provided, had to be taken out. The machines had to travel at their lowest speed a definite distance without losing in altitude, and 50 points were to be allocated to the competitors able to travel at no more than 63 kilometres per hour. Two points were deducted for every additional kilometre or part, so that with a slowest speed of 88 k.p.h. no points could be obtained. A repetition of the test with half the normal rating was permissible. No fewer than seven competitors were able to fulfil the conditions and gain full marks. These were the Italians Colombo, Lombardi, Miss Spooner (in the Italian team), the Poles Zwirko and Karpinski (RWD—6) and the two Germans Junck and Seidemann (both Heinkel). Close up with 48 points were the Italians Donati, Stoppani, Suster, the German Morzik (Heinkel),

CZECHOSLOVAK STYLE : Kalla, on one of the Praga B.H. 111 (Gipsy III) monoplanes, goes over the top.

the Frenchman Delmotte (Caudron) and the German von Massenbach (Heinkel).

The take-off test over a flag-lined rope stretched eight metres high over the field proved exceedingly exciting, as the competitors, anxious to gain the maximum number of points, performed some hair-raising acrobatic feats. These, of course, are not actually in keeping with the intentions of the organisers, but they were splendid to behold! This starting test, like the landing test, is less a trial of machines and engines than of the skill of pilots. Colombo lined up 100 metres from the obstacle, which is the longest distance to obtain full marks, and, darting up to the rope, he zoomed up so that the machine all but stood vertically on its tail, barely missing the rope with the wheels. Lombardi's performance looked even more daring. He was evidently in high spirits as he, having lined up only 97½ metres from the rope, merrily put out his tongue to

DISMANTLING AND ERECTING : The Polish pilot, Giedgowd, and his PZL (Gipsy III) monoplane "gatecrashing."

the onlookers as he dashed up the short course and almost turned his machine on its back in repeating Colombo's performance. This test was carried through in groups, and was distributed over several days. So it came about that the feat of these two was not repeated till August 17, when Wolf Hirth accomplished the take-off with a distance of only 91½ metres from the rope. These three competitors thus obtained the full number of marks, namely, 40. Poss in his "Klemm," who must have misjudged his distance from the rope as he lined up 100.3 metres away, *i.e.*, scarcely one foot beyond the full-marks border, was able to acquire only 39 points for this reason, while 38 points were secured by the Italians Viazzo, Donati and Suster, and by the German "Klemm" pilots Osterkamp and Lusser. The Heinkel pilots gained between 30 and 36 points, one dropping out altogether. Miss Spooner was able to collect 35 points and Stoppani and Angeli (Breda-33) as also the Pole Zwirko (RWD-6) 37 points each.

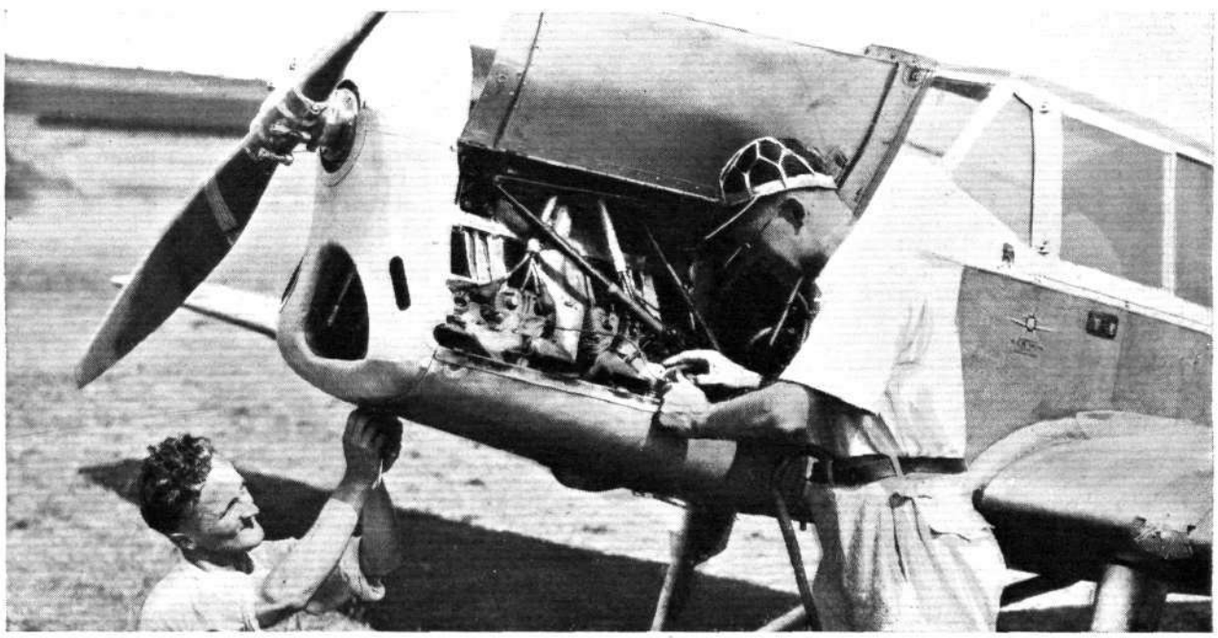
In the meantime two competitors had given up. Carberry had succeeded in gaining 72 points with his new Gipsy-engined "Klemm" in the equipment rating, which was normal for this make, and 32 points in the slow-flying test. He was in no wise handicapped, but, nevertheless, chose to retire from the competition for no apparent reason. The retirement of the Frenchman Puget with his Salmson-engined Farman was more intelligible, since he had only gained 46 equipment points, of which he then lost 15, owing to his inability to complete the dismantling and refitting of his machine twice running within 15 min. Furthermore, he gained no points in the engine-starting test. With these two competitors out, there thus remained 41, which completed the technical tests.

The landing test was similar to the starting, and was very hard on landing gears. During practice several machines had buckled their undercarriage struts, but it was possible to repair these defects within the allowed time, although, for some time, it was doubtful if Wolf Hirth (one of the victims), Delmotte and Seidemann would be able to effect repairs so that they could carry on. In the landing test Miss Spooner excelled all other competitors, as she was able to bring her machine to a standstill within the extraordinarily short distance of 92.4 metres from the rope. Poss ("Klemm") came near her with 97.8 metres. Both gained the full 40 marks. Third was Viazzo with his Breda-33 and a distance of 101.9 metres. He gained 39 points, as did Détré (Potez), who stopped at 102.8 metres. Then followed Zwirko (RWD-6) with a distance of 105.8 metres, who booked 38 points, like Colombo with his Breda for a distance of 107.3 metres. Also the Swiss "Fretz" ("Klemm-Gipsy III"), who stopped at 107.4 metres, collected 38 points. The least number of points, eight, was gained by the Akaflieg cantilever biplane in the hands of Marienfeld. This machine is scarcely suited for this competition, since it is of the pronounced fast sporting type, which cannot travel under 81 kilometres per hour at best. The machine required 259.6 metres to come to a standstill, which was partially due to inefficient wheel brakes. But the Akaflieg machine was by no means alone, as several other competitors only gained between 9 and 15 points. The majority, however, was able to achieve round about 30 points. Wolf Hirth, with his "Klemm," stopped at 110.9 metres, and was allocated 37 points, of which also Donati in his Breda-33 was recipient.

On Friday, August 19, after a day of rest, the fuel consumption test was carried through over a triangular course 300 kilometres (186 miles) in length. This was the same course over which the race is to go at the finish of the air tour, except that in the latter the competitors will land at the Tempelhof airport, while in the fuel test they landed at the Staaken airport. The competitors were not allowed to make any alterations whatsoever to their engines and carburetters, which had to remain in exactly the same condition, not only during the whole of the technical tests but for the whole air tour. No jet or choke may, therefore, be tampered with. The organisers have also learned from the experience they gained during the 1930 contest, in which the fuel consumption test almost assumed the character of an acrobatic feat, with the planes hanging tail-down on their propellers. This time the speed attained is being taken into account The 300 kilometres are being added to the air-tour mileage, and too low speed maintained by the competitors during the fuel consumption test will detract from their average speed rating in the air tour. The pilots, for this reason, have an incentive to maintain as fast a speed during this test as is well compatible with economy of fuel consumption.

Machines of the first category were to receive 30 points if they consumed not more than 7½ kilogrammes of fuel per 100 kilometres (26.6 lb. per 100 miles). For every additional ½ kg. used for every 100 km., one point was to be deducted from the 30, so that anyone using as much as 22½ kg. per 100 km. would receive no points. For the second category only 5 kg. were allowed per 100 km., one point being deducted from the 30 for every 0.33 kg. used in excess of 5 kg. Each competitor was allowed a second try in the event of his engine having given trouble during the first attempt, which had to be proved. If also the second attempt failed, the test was cancelled for the competitor, who thus lost the points he could have obtained in it.

The fuel consumption test was a considerable success for the German competitors with Argus engines. The full number of marks were obtained by the Klemm pilots Poss and Osterkamp with Argus engines, and Cuno with a Siemens engine, the Heinkel pilots Junck (with an Argus and not a Gipsy engine as was originally reported),



THE NEW HIRTH ENGINE : Herr Wolf Hirth at work on his brother's new 8-cylinder inverted vee engine, which is of 150 h.p.

Morzik, Stein and von Massenbach. Also the Akaflieg machine with Argus gained full 30 marks and the Gipsy-engined Farman of Lebeau. Four competitors, Lusser, Seidemann, von Cramon with Argus-engined Klemms and Heinkels, and the Czecho-Slovakian Mares, with his Gipsy-engined Praga, attained 29 points each. The Italians had to be satisfied with 25 and 26 points.

This test concluded the technical events, and now the machines are well on their way on the great Circuit of Europe. To the Germans the results of the technical tests have been all but gratifying. The equipment rating has given them an unexpected setback, and the loss in points they sustained in this they have only partially been able to make good. It almost looks, indeed, as if already these tests have brought the decision for the whole contest to the Italian and Polish machines, and the engines employed in them are not likely to prove less reliable than the German machines and engines. The maximum number of points available for average speed on the air tour is 180, which will be allocated for an average speed of 200 km./hr. (124 m.p.h.) for the large machines, while, in order to gain this number of points, Nicolle's small Mauboussin will have to maintain an average of 175 km./hr. (109 m.p.h) over the 7,500 km. (4,650 miles) plus the 300 km. (186 miles) of the fuel-consumption test, which is well-nigh impossible of achievement for the small 40 h.p. Salmson engine.

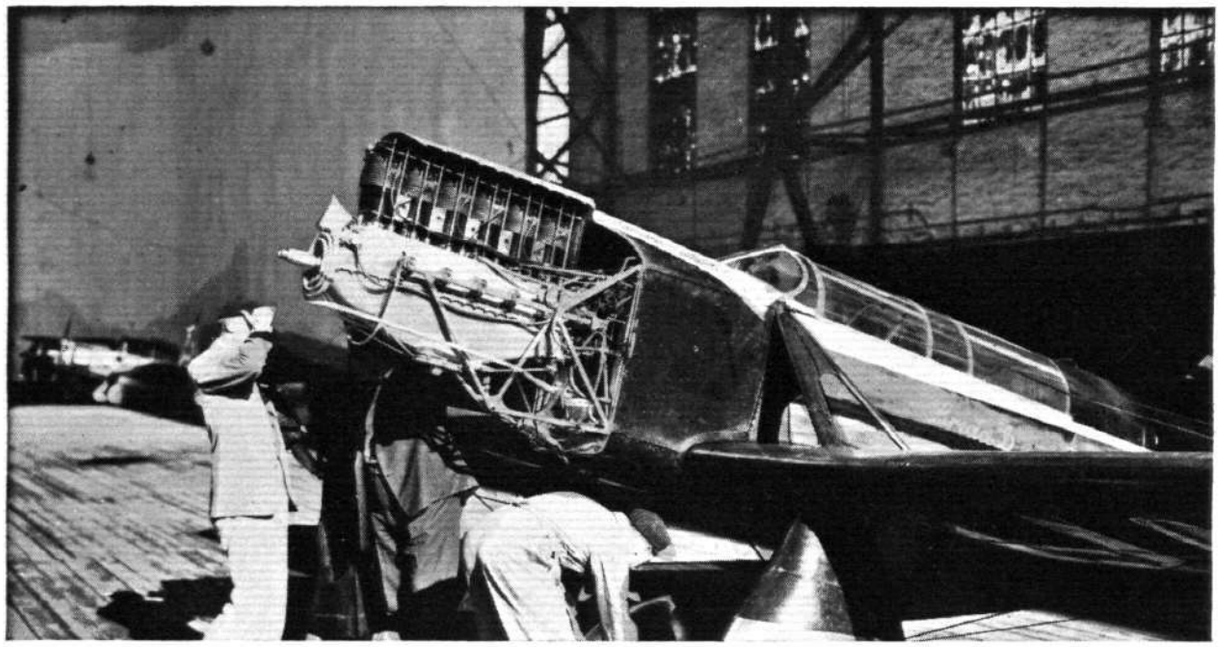
The favourite competitor at the end of the technical tests is Colombo, with his Breda—33, who holds 247 points. He is followed by the Pole Zwirko, with his RWD—6, having 245 points. Lombardi is third with 242 and Miss Spooner fourth with 241 points, which number is also held by Donati. Sixth is another Breda pilot, Stoppani with 238 points, and the Pole Karpinski, with the second RWD—6 machine, as seventh on the list. Then follows another Breda, with Suster, having 235 points, and now comes the first German machine, the Klemm-Argus, of Poss, with 234 points. The Swiss Klemm-Gipsy, of Fretz, holds 231 points as tenth, and is followed by Wolf Hirth's Klemm, with Hirth engine, having 230 points. The first Heinkel, the Argus-engined machine of Junck, is in twelfth position with 225 points, and Morzik's Heinkel-Argus is thirteenth with 224 points, on a level with Cuno's Siemens-engined Klemm.

THE CIRCUIT OF EUROPE

In next week's issue we expect to publish Herr Heinze's account of the events and results of the Circuit of Europe, which concludes the International Touring Competition.

In the meantime we have thought our readers might be interested to learn of certain happenings which, we regret to say, have very much marred what should and could have been a strenuous but thoroughly friendly contest.

The trouble began with Miss Winifred Spooner withdrawing from the contest. On Saturday, August 20, while flying with other competitors from the Staaken aerodrome, where the technical tests had been held, to the Tempelhof aerodrome, from which the Circuit of Europe started, she had a forced landing caused by trouble with the fuel supply. It is reported that when an examination was made, a quantity of dirt and cotton waste was found in her petrol filter. This prevented the flow of fuel and starved the engine. In certain quarters it has been hinted that foul play was suspected, but until more definite information is available it would be very unwise to form hasty conclusions. The only thing certain appears to be that Miss Spooner is definitely out of the contest, which seems a thousand pities after she had been doing so extremely well in the technical tests, gaining fourth place against some of the crack pilots of Europe.



FOR SMOOTH RUNNING : The Colombo engine fitted in the Breda 33 machines is of the 6-cylinder, in-line, type.

A French pilot, M. Massot, who was flying a Guerchais monoplane, has had all his points from the technical tests cancelled, because he had not carried in the tests the same weight as when he weighed-in before the start.

One of the German pilots, Herr v. Cramon, who was flying a Heinkel monoplane with Argus engine, suffered a broken crankshaft and made a forced landing near Kattowitz. He landed safely, but as a crankshaft may not be replaced, he is out of the competition.

Straumann, on the Comte (Swiss) monoplane, developed wing flutter when approaching Vienna, and persuaded his passenger to jump out by parachute. The passenger landed safely and arrived in Vienna by car. Straumann carried on and reached the Vienna aerodrome safely, but has retired from the contest.

The worst mishaps of all have, however, overtaken the Italian competitors. Suster, flying a Breda 33 (Colombo) was circling the control point at Albenga when his wings broke. The pilot escaped by parachute, but his passenger was killed, due, it is reported, to the failure of his parachute to open properly. It seems likely that the altitude was insufficient.

Another Italian pilot, de Angeli, also flying a Breda 33, crashed near Cannes. It is reported that he had aileron trouble and sideslipped. He and his passenger were, fortunately, unhurt.

As a result of these two crashes the Italian Air Ministry has ordered the withdrawal of all the Breda 33 machines in order not to expose the crews to unnecessary risks. An inquiry is to be held into the causes of the accidents.

Airport News

CROYDON

NEARLY everyone, owing to the weather of the past week, although delightful as it was for flying, threw convention to the winds, and dressed to suit personal comfort. At least, we were thankful we were not tied up in the city, sweltering in a temperature that must have been almost unbearable. Although most of the aerodrome staffs were dressed in flannels and open-neck shirts, it was far from being an untidy sight. Everyone looked cool and neat, and city folks, who regard the comfort of the "workers" last, would have done well to have paid the Croydon Airport a visit. The pilots on the air routes have felt the oppressive heat even at such altitudes as three thousand feet. Mr. Rogers, of Imperial Airways, who flew the Polytechnic special to Basle, declared that he flew in his shirt sleeves and a pair of light slippers. Some *negligé*!

Several "A" licence pilots, who have been passed out for their "B" licence, have completed their night flights during the week.

Mr. A. C. M. Jackaman has paid several visits on his new "Monospar." On one occasion he arrived almost with the milk, having left Manchester about 11 p.m., landing at Croydon in the early hours of the morning.

The "Atalanta" has been carrying out various tests, petrol consumption, wireless, etc. It is understood that it is a good machine to fly—and is also very comfortable from the passenger point of view. She is shortly to carry out extensive tests in short-wave radio.

Imperial Airways had a narrow escape from losing "Helena," one of the H.P.42 class, in Paris. Mr. Jones was making a night landing at Le Bourget, and a "Holt" flare immediately fired the starboard lower plane. The fire spread rapidly, but the promptness of the Air Union Le Bourget fire brigade saved the situation, and it was extinguished just as the flames reached the fuselage and centre section. Fortunately, no passengers were on board at the time. The machine had gone over to deal with an inward rush of passengers. Naturally, it rather upset traffic arrangements. The machine will probably be out of service for at least two months.

The Luft Hansa Croydon-Berlin and Berlin-Croydon night air mail service has been extended to run until October 31.

Rumour hath it that Imperial Airways are contemplating operating a two-way 5 p.m. service from London to Paris throughout the winter months. This service is certainly needed, but it remains to be seen with which type of aircraft they propose running, and whether the usual bad weather will defeat them.

Traffic figures for the week:—Passengers, 2,474; freight, 86 tons.

P. B.

FROM HESTON

SUNDAY, August 14 (late news).—Among the night flyers was Mr. Gordon Selfridge, Junr., who is becoming a regular participant in this pastime.

Monday.—Five aeroplanes cleared Customs inwards from Berck after week-ends on the Continent. Mrs. Mollison arrived from Ireland in G—ABVW to obtain some spares for her husband prior to his departure on his double Atlantic crossing.

The Junkers of Personal Flying Services, Ltd., returned from Berck, piloted by Capt. W. Ledlie.

Brian Lewis & Co., Ltd., report having sold two new "Puss Moths"—one to Lord Furness and one to Dunlop Rubber Tyre Co.

Tuesday.—Mrs. Mollison (Miss Amy Johnson) set off for Ireland to rejoin her husband.

Capt. J. Taylor, of Shell Mex-B.P., returned in the company's "Puss Moth," after a four days' tour of Ireland with the Managing Director of the Irish Company and Col. Russell, late of the Irish Free State Air Force. They had been surveying for possible landing grounds.

Customs clearances to-day were two to Berck, one to Ireland and one to Brussels.

Wednesday.—Mr. A. C. Goldsmith qualified for his "A" licence.

Mr. Partridge departed for the Continent, with one passenger in his "Moth," intending to fly to Norway should the weather prove favourable, otherwise making for the South of France.

Mr. S. Cotton left for Berck in his Monocoupe.

Thursday.—In the afternoon Mr. Ahrlers arrived from Brussels in "Moth" G—ABXZ.

One of our old friends turned up to-day in the person of F/O. Ivins, who left once more for Jersey in his veteran old Bristol Fighter, with Hispano engine. Mr. Coote Vaughan left for Berck in his "Moth."

Personal Flying Services, Ltd., sent their Junkers, piloted by Capt. W. Ledlie, to Berck with one passenger, returning with two others. After clearing Customs the Junkers proceeded to Warwickshire with the two passengers.

Mr. Nigel Seeley, after dashing in to clear Customs in great haste for St. Ingelvert, was delayed, after taxying out to take off, with a broken skid. Airwork Service Department, with great promptitude, took a new one to the machine in a car and fitted it on the spot—thus ensuring the minimum of delay.

The Hon. Mrs. Montague, accompanied by Mr. Rupert Bellville, left to-day for China in "Moth" G—AAJO.

Mrs. Mollison arrived from Ireland, after witnessing the departure of her husband on his successful Atlantic flight. Capt. Birkett also returned from Ireland in a "Puss Moth," of Air Taxis, Ltd., with pictures of Mollison's departure.

Night flying was carried out from 10 p.m. continuously up to 12.20 a.m.

Friday.—The Junkers of Personal Flying Services returned from Warwickshire in the morning with one passenger and left for Brooklands.

Quite a fleet of machines appeared just after 4 p.m. Banco's Fokker "The Spider" left for Deauville with seven passengers, followed by the Junkers of Personal Flying Services for Berck with four passengers and a Hillman's "Puss Moth" soon after for Biarritz. Banco's "Puss Moth" left later for Berck with one passenger, returning at 8.40 p.m. with one other—the return journey being made in the quick time of 55 min. P.F.S. Junkers was the last arrival in—landing at 8.50 p.m. from Berck with one passenger.

Lady Howard de Walden flew in a Klemm from Heston to Chirk accompanied by Capt. Cameron, who brought the machine back to Heston.

Saturday.—Customs clearances commenced at an early hour—a Hillman's "Puss Moth" leaving at 7.30 a.m. for Waterford, Ireland, with an assessor to survey a mansion after a fire. This machine reached Heston on the return journey at 6 p.m. Capt. Preston left at 8 a.m. for Rotterdam in the "Puss Moth" of First International Investment Agency. Capt. W. Ledlie, of Personal Flying Services, left with the Junkers with four passengers for Berck, and Senor Folonari, with one passenger, left in a new "Puss Moth," of which he had just taken delivery at Stag Lane, for Amsterdam.

A Hillman's "Puss Moth" took two passengers to Bournemouth during the afternoon.

The Airwork School of Flying had a full day's instruction and during the afternoon a "Puss Moth" was kept continuously on the go with trips over Windsor and London, while a passenger was taken to Abingdon in one of the School machines.

September 1 will be a busy day at Heston on the arrival of the foreign visitors accepting the invitation of their British friends for a *Week-End Aérien*. They are expected to number 100.

We are assured that after the round of visits the party is making to different aerodromes and clubs they will leave with a feeling that British aviation is not lacking in any way as regards hospitality.

The Industry

A BOOST GAUGE

WITH all supercharged and high-compression aero engines it is necessary for the pilot to have an accurate knowledge at any moment of the absolute pressure in the induction pipe of the engine, and the Boost Gauge serves this purpose.

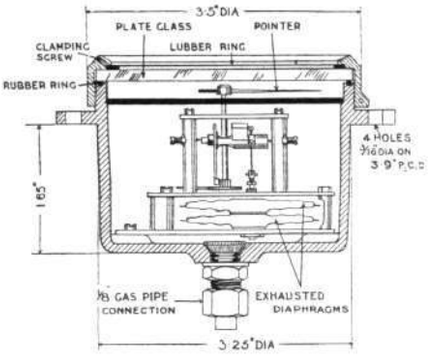
An engine is designed for and gives its maximum output for a definite maximum induction pipe pressure, and a small pressure difference means a big difference in h.p. The efficiency of the supercharged engine is largely governed by the correct pressure in the induction pipe being maintained.

Too low a pressure means loss of power, while excessive induction pipe pressure may seriously damage the engine. To avoid this the controls are usually arranged so as to give only a limited throttle opening on the ground and at low altitudes, but any subsequent control must be gauged by the pilot from the induction pipe pressure.

This pressure is an absolute one, and is not affected by the pressure of the atmosphere surrounding the engine. An ordinary pressure gauge connected to the induction pipe would not give the indications required, as it would only show the difference between the pressure existing inside and outside the Bourdon tube or diaphragm movement, whereas what is required to be known is the actual or absolute pressure in the induction pipe irrespective of that of the outer air.

Air Ministry Mark IIa Boost Gauge, made by Negretti and Zambra, of 38, Holborn Viaduct, E.C., is used in large numbers both in our own Air Force and several foreign air forces. The whole movement is contained in an airtight case with only one connection, which leads to the induction pipe of the engine. When this is connected up a reading is unaffected by any external barometer variation, and only shows the absolute or true pressure in the induction pipe.

The movement consists of two sets of exhausted nickel-plated tempered steel diaghragms operating a spindle on point bearings through a crank and link mechanism. Attached to the spindle a quadrant meshes with a pinion on the pointer spindle. On applying suction to the pipe connection, the diaphragms expand and operate the pointer through this geared mechanism. Provision is also made to withstand excessive overloads such as might occur when an engine backfires.



The Negretti and Zambra Boost Gauge.

Originally this instrument was made with an Aneroid Barometer movement, consisting of a nickel-silver diaphragm with a chain and pulley mechanism. This movement was found unsatisfactory owing to the effect of vibration, position error, zero shift and general lack of reliability and accuracy.

A "Power" cruiser with tropical awning. (FLIGHT *Photo.*)

POWER BOATS FOR TROPICS

A NUMBER of 30-mile-an-hour cruisers, equipped specially for operating in tropical conditions, are now being delivered by the British Power Boat Co. of Hythe to R.A.F. marine air bases abroad.

Included in the equipment of these rescue cruisers is a closed cabin, which can accommodate a number of stretcher cases.

The new tropical type rescue cruisers have copper bottoms and are fitted with large awnings to protect their crews from the heat of the sun.

They are to be stationed at the R.A.F. seaplane bases at Aboukir, Malta, Basra and Singapore.

Beacons for Transatlantic Air Traffic

A REMARKABLE engineering feat, carried out in the face of almost insurmountable difficulties, has been performed by the "Companhia Aga do Brazil," a subsidiary of the Swedish Aga Company, in building a lighthouse for aviation and shipping on a desolate reef a considerable distance off the Brazilian coast. The work was carried out on the almost inaccessible islands Penedos de Sao Pedro e Sao Paolo and it was primarily the needs of transatlantic aviation that decided the Brazilian Government to have this lighthouse constructed. Owing to the great difficulty in landing on rugged and forbidding rocks the only possibility was to select an "Aga" beacon, the well-known invention of Dr. C. Dalen, the blind Swedish Nobel prize winner who lost his sight while experimenting with the accumulation of gas needed for these lights. The "Aga" beacons through an ingenious device, called the "sun-valve," function automatically, extinguishing themselves at daylight and switching on the light at dark or in a fog without being touched by a human hand for more than a year. When the gas mantle is burnt out it is automatically replaced. Besides this lighthouse, said to be one of the most powerful in the South American waters, a reserve beacon has been built on the same islands and constructed so as to function automatically if the main light should for some reason get out of order. A third "Aga" lighthouse intended for the same flying route has been built at Calcanhar in the State of Rio Grande del Norte at the point where the aviators arrive at the coast of Brazil.

1932 International Balloon Race

THE International Balloon Race for the Gordon Bennett Cup will be held this year at Basle, Switzerland, and is to start on September 25. The Bennett Cup has been won nine times by the United States, five times by Belgium, twice each by Switzerland and Germany, and once by France. The original cup has been twice replaced, Belgium winning it permanently in 1924, the United States winning the second cup put up by the people of Belgium, and the third cup, now in competition, being offered by the Detroit Board of Commerce.

A Signpost for Renfrew

AIRMEN passing over Glasgow en route for Renfrew Aerodrome will now be helped by a direction indicator on the gasometer which stands on the south bank of the Forth and Clyde Canal at Temple. The container has been entirely recovered with aluminium paint. The crown of the container will be marked with a thick red line to indicate in which direction the aerodrome lies. Greenock has its name painted on the top of its gasometer.

THE ROYAL AIR FORCE

London Gazette, August 16, 1932.

General Duties Branch

The following Pilot Officers are promoted to rank of Flying Officer:—D. M. Lynch-Staunton (January 11); J. P. Cecil-Wright (June 20); H. G. Blair (June 29); F. C. Seavill (July 29).

Sqdn.-Ldr. A. H. Wann is placed on half-pay list, Scale A, from August 7 to August 18, inclusive:—Sqdr.-Ldr. P. Huskinson, M.C., is placed on half-pay list, Scale B, from August 10 to August 21, inclusive; Ft. Lt. J. F. Titmas is placed on half-pay list, Scale A (August 8); Lt. W. S. North, R.M., F/O., R.A.F., ceases to be attached to R.A.F. with effect from July 12, on return to duty with the Royal Marines, and is re-attached to R.A.F. as a Flying Officer with effect from July 18 and with seny. of January 12, 1930; F/O. F. P. Hewitt is placed on retired list at his own request (August 17); Ft. Lt. G. H. Walker is transferred to Reserve, Class A (August 17).

ROYAL AIR FORCE RESERVE
RESERVE OF AIR FORCE OFFICERS

General Duties Branch

E. A. Williams is granted a commn. in Class AA (ii) as Pilot Officer (July 29); N. S. T. Benson is granted a commn. in Class AA (ii) as Pilot Officer on probation (August 3); Flight Lieutenant C. R. Vaughan is transferred from Class A to Class C (August 12); F/O. H. A. Howes is transferred from Class C to Class A (June 5, 1931).

AUXILIARY AIR FORCE

General Duties Branch

No. 608 (NORTH RIDING) (BOMBER) SQUADRON.—Pilot Officer G. H. Ambler is promoted to rank of Flying Officer (August 7).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Wing Commander.—J. O. Andrews, D.S.O., M.C., to No. 209 Sqdn., Mount Batten, 10.8.32, to command *vice* Sqdn. Ldr. J. H. O. Jones.

Squadron Leader.—E. B. C. Betts, D.C.S., D.F.C., to H.Q. Wessex Bombing Area, Andover, 8.8.32, for Air Staff duties, *vice* Sqdn. Ldr. J. J. Green.

Flight Lieutenants.—E. B. Steedman to Cambridge University Air Sqdn., 5.8.32. G. E. Campbell, D.F.M., to Aeroplane and Armanent Experimental Estab., Martlesham Heath, 5.8.32. A. Allen to Marine Aircraft Experimental Estab., Felixstowe, 5.8.32. J. D. F. Bruce to R.A.F. Base, Gosport, 5.8.32. W. L. Freebody to R.A.F. Reception Depot, West Drayton, 5.8.32. H. Waring to R.A.F. Base, Gosport, 5.8.32. F. C. Rowland, to R.A.F. Storage Section, Cardington, 8.8.32. C. C. Bazell, to Elec. & Wireless Sch., Cranwell, 11.8.32. H. W. Taylor, to No. 33 Sqdn., Bicester, 8.8.32.

Flying Officers.—H. G. Wisher to No. 1 Sch. of Tech. Training (Apprentices) Halton, 5.8.32. G. F. Simond to Experimental Section, Royal Aircraft Estab., S. Farnborough, 5.8.32. P. F. G. Bradley to R.A.F. College, Cranwell, 5.8.32. J. F. X. McKenna to Experimental Section, Royal Aircraft Estab., S. Farnborough, 5.8.32. L. V. Bennett, to R.A.F. Training Base, Leuchars, 5.8.32.

Stores Branch

Wing Commander.—W. C. Clark, to H.Q., Wessex Bombing Area, Andover, 8.8.32, for Stores Staff duties.

Squadron Leaders.—A. J. M. Ross, M.B.E., to R.A.F. Storage Section, Peterborough, 8.8.32, for Stores duties. W. G. M. Nicholl, to H.Q., R.A.F., Halton, 8.8.32, for Stores duties, *vice* S./Ldr. W. J. King. R. A. Young, to Air Ministry, Dept., of A.M.S.R. (D. of E.) 8.8.32, for Stores Staff duties *vice* W./Cdr. W. C. Clark.

Flying Officers.—F. B. C. Fundrey to No. 1 Stores Depot, Kidbrooke, 5.8.32. M. W. Keey, to Station H.Q., Upavon, 8.8.32. C. J. Nobbs, to H.Q., R.A.F., Middle East, Cairo, 25.7.32.

Dental Branch

Flying Officer.—D. I. Malcomson, to R.A.F. Depot, Uxbridge, 8.8.32.

NAVAL APPOINTMENTS

The following appointments have been made by the Admiralty:—

Commr. (Flight Lieut. R.A.F.).—R. St. A. Malleson, A.F.C., to *President* for Naval Air Division (September 5).

Lieut.-Commrs. (Flight Lieuts., R.A.F.).—R. A. Peyton, to *Courageous* for 446 Flight, in command (August 26); and H. L. St. J. Fancourt, to *Victory*, for R.A.F. Base, Gosport (September 12), and to *Furious* for 449 Flight, in command (September 19).

Lieuts. (Flying Officers, R.A.F.).—H. M. King, to *Furious* (August 15). C. R. V. Pugh, to *Norfolk*, and for 443 Flight (August 22); and E. O. F. Price to *Courageous*, and for 446 Flight (August 27).

R.A.F. Intelligence

THE Air Minister announces:—An adequate intelligence organisation is an important factor in the general scheme of air control in those Eastern countries for whose defence the Royal Air Force is responsible, and it is necessary to maintain a constant flow of officers with a knowledge of Middle Eastern languages and experience of intelligence work in order to meet staff requirements in time of war. To secure these ends the following policy has been laid down in regard to the provision and training of officers for this type of duty. *Junior posts.*—About half the posts for flight lieutenants (air staff intelligence) on the strength of the headquarters of the Iraq, Palestine and Transjordan, Middle East and Aden commands will be filled by permanent officers, and the remainder by officers specially appointed on the supplementary list or seconded from the Army for this type of work only. In principle, all officers actually performing staff duty at headquarters will be permanent officers, and a proportion of the officers employed on special service duty away from headquarters will also be permanent officers. *Training.*—Two permanent officers of the rank of flight lieutenant or flying officer will be selected and sent each year to Iraq to study a Middle Eastern language—Arabic or Kurdish at the discretion of the A.O.C.—for a period of one year or until they pass the preliminary examination. *Subsequent employment.*—On conclusion of training, officers will be posted for a further two years' duty as intelligence officers in Iraq, Aden, Palestine, Transjordan or the Sudan. Towards the end of this period they should be able to pass the interpretership examination and receive the prescribed awards of £60 for qualification as a 1st class interpreter or £30 for qualification as a 2nd class interpreter and gain an antedate for promotion. Officers who have rendered satisfactory service in intelligence duties will receive special consideration when selection of officers to undergo the Staff College Course is being made, and the opportunity, therefore, of gaining a further antedate for promotion. *Higher intelligence posts.*—Higher intelligence posts in the rank of squadron leader and wing commander will as a rule be filled by permanent officers who have completed a tour of duty in a junior intelligence post, have qualified at the Staff College, and have again become due for service abroad.

Napier Trophy for Bomber Squadron

No. 45 (BOMBER) SQUADRON, which last year flew a greater number of hours than any other unit in the R.A.F., has been presented with a silver model of the Napier Lion engine, with which its Fairey III.F. aeroplanes are fitted. This will serve as a trophy for competition annually between the flights of the squadron. The model, mounted on an ebony plinth and suitably inscribed, was presented by Sir Harold Snagge, chairman of the Napier Company, to Sqd. Ldr. F. J. Vincent, who was the commanding officer of the squadron up to a few months ago. It is to be retained by the squadron, which is at present stationed at Helwan.

The Northamptons Fly Back to Egypt

IN June the 1st Battn. the Northamptonshire Regiment, 14 officers and 534 men, were hurried by air from Egypt to Iraq to take over the duty of guarding aerodromes from the Iraqi troops who had disbanded. They were taken north in 18 "Victorias" (Napier Lions) of Nos. 70 B.T. Squadron from Hinaidi and 216 B.T. Squadron from Heliopolis. Owing to the urgency of the move, the machines were heavily loaded, and some delay occurred in the desert. Now that the regiment has completed its duties in Iraq, it has been flown back to Egypt, but the move was carried out in more leisurely fashion in nine "Victorias" supplied by the same two squadrons, and the same difficulties were not experienced. The distance covered across the desert is about 1,730 miles.

Move of Nos. 23 and 32 (Fighter) Squadrons to Biggin Hill

STATION Headquarters and Nos. 23 and 32 (Fighter) Squadrons will move from Kenley to Biggin Hill during the last two weeks of September, completing the move by October 1, 1932.

Cricket; R.N. beats R.A.F. at Lords

THE cricket match between the Royal Navy and the Royal Air Force was held at Lords on August 15-16. The R.A.F. made 209 and 155, and the Navy scored 256 and 110 for 5, thus winning by five wickets.

AIRCRAFT COMPANIES' STOCKS AND SHARES

FOR the greater part of the month all sections of the Stock Exchange have been somewhat more active than is usual during August, when holiday influences tend to make for a decline in business. This reflects the rally shown by New York markets, the upward movements in commodity prices, the success of the conversion operation and the decisions of the Ottawa conference. Shares of companies connected with the aircraft and associated industries participated in the rises established by leading industrial shares during the month. Reference was made here last month to the yield then obtainable on Fairey Aviation shares; the price has since rallied from 11s. 10½d. to 15s. Imperial Airways perhaps attracted most attention and show a further rise on the month from 16s. 6d. to 20s. 3d., accompanied by market talk that the external value of the pound sterling is continuing to assist the company in competing for business. The report and accounts are usually issued next month; there is continued hope in some quarters of a small increase in the dividend. De Havilland are better on the month at 15s., against 13s. 6d., having come in for support following Mr. Mollison's flight to America. D. Napier are 3s. 9d., compared with 3s. a month ago and the 8 per cent. preference have gained 2s. 6d. to 12s. 6d. The 7½ per cent. preference remained at 20s. The half-yearly dividend on the 8 per cent. preference is normally payable on September 30. Handley-Page preference rallied to 10s. Dunlop Rubber shares have been in request partly on the hope that the company is doing a better business and partly owing to the belief that operations in Canada will benefit from decisions made at Ottawa. It may be recalled that last year an announcement was issued at the end of September that no half-yearly dividends were to be paid on the preference shares on their due dates. The dividends were subsequently met in full when the report was published, and the market seems hopeful that the interim preference dividends will be forthcoming on this occasion. Rolls-Royce show a rise from 36s. 9d. a month ago to 38s. 6d. and Joseph Lucas were fairly steady on the hope that the payment for the year may again be brought up to 20 per cent. Triplex Safety Glass had a gain of 4s. on the month, aided by the announcement that the dividend is to be maintained at 10 per cent. A point of interest has been a rally in British Oxygen from 12s. 6d. to 15s. A year ago the directors announced their decision with regard to the interim dividend in September. Oil shares benefited from the increased attention given to shares with an international market and from hopes attaching to the further oil conference to be held in New York next month.

Name.	Class.	Nominal Amount of Share. %	Last Annual Dividend.	Current Week's Quotation.
Anglo-American Oil	Deb.	Stk.	5½	101½
Armstrong Siddeley Develop.	Cum. Pref.	£1	6½	13/9
Birmingham Aluminium Castg.	Ord.	£1	5	18/–
Booth (James), 1915	Ord.	£1	15	46/–
Do. do.	.. Cum. Pref.	£1	7	26/–
British Aluminium	Ord.	£1	5	23/9
Do. do.	.. Cum. Pref.	£1	6	21/3
British Celanese	Ord.	10/–	Nil	6/–
British Oxygen	Ord.	£1	3	15/–
Do. do.	.. Cum. Pref.	£1	6½	21/3
British Piston Ring	Ord	£1	10	25/–
British Thomson-Houston	.. Cum. Pref.	£1	7	26/10½
Brown Brothers	Ord.	£1	10	26/3
Do. do.	.. Cum. Pref.	£1	7½	26/3
Dick (W. B.)	.. Cum. Pref.	£10	5	120/–
De Havilland Aircraft ..	.. Ord.	£1	5	15/–
Dunlop Rubber	Ord.	c	Nil	15/4½
Do. do.	.. "C" Cum. Pref.	16/–	10	15/6
En-Tout-Cas (Syston) ..	.. Def. Ord.	1/–	Nil	–/9
Do. do.	.. Ptg. Pfd. Ord	5/–	8	2/6
Fairey Aviation	Ord.	10/–	10*	15/–
Do. do.	.. 1st Mt. Deb.	Stk.	8	110
Firth (T.) & John Brown	.. Cum. Pref.	£1	6D	4/–
Do. do.	.. Cum. Pref.	£1	5*D	4/–
Ford Motor (England) ..	Ord.	£1	Nil.	20/6
Fox (Samuel)	Mt. Ptual. Deb.	Stk.	5	82½
Goodyear Tyre and Rubber ..	Deb.	Stk.	6½	106
Handley Page	.. Ptg. Pref.	8/–	12½	10/–
Hoffmann Manufacturing ..	Ord.	£1	Nil	15/7½
Do. do.	.. Cum. Pref.	£1	7½	18/9
Imperial Airways	Ord.	£1	3	20/3
Kayser, Ellison	Ord.	£5	Nil	55/–
Do. do.	.. Cum. Pref.	£5	6	72/6
Lucas (Joseph)	Ord.	£1	20	61/10½
Napier (D.), & Son	Ord.	5/–	Nil	3/9
Do. do.	.. Cum. Pref.	£1	7½	20/–
Do. do.	Pref.	£1	8	12/6
National Flying Services ..	Ord.	2/–	Nil	–/3
Petters	Ord.	£1	Nil	15/–
Do.	.. Cum. Pref.	£1	7½	13/9
Roe (A. V.) (Cont. by Armstrong-Siddeley Devel., *q.v.*)	Ord.	£1	—	—
Rolls-Royce	Ord.	£1	10	38/–
Smith (S.) & Sons (M.A.)	.. Def. Ord.	1/–	Nil	–/9
Do. do.	.. Pt. Pfd. Ord.	£1	7	11/3
Do. do.	.. Cum. Pref.	£1	7½	13/9
Serck Radiators	Ord.	£1	15	31/6
"Shell Transport & Trading ..	Ord.	£1	7½*	46/3
Do. do.	.. Cum. Pref.	£10	5	£11
Triplex Safety Glass	Ord.	£1	10	38/–
Vickers	Ord.	6/8	5	6/6
Do.	.. Cum. Pref.	£1	5*	17/3
Vickers Aviation (Cont. by Vickers, *q.v.*)	—	—	—	—
Westland Aircraft (Branch of Petters, *q.v.*)	—	—	—	—

* Divident paid tax free. c £1 unit of stock. D Last xd. March, 1931.

The Royal Aeronautical Society

(with which is incorporated the Institution of Aeronautical Engineers)

Lecture Programme, 1932-1933

October 6.—Captain N. Macmillan, M.C. *Air Navigation.* Joint lecture with the G.A.P.A.N.
October 20.—Flt.-Lieut. W. G. Pudney. *Flying Conditions on the West Coast of Africa.*
November 3.—H. G. Travers, D.Sc. *Civil Primary Training.*
November 10.—D. L. Hollis Williams, B.Sc. *Airscrew Design.*
November 24.—Sqd.-Ldr. H. Leedham, O.B.E. *The Evolution of Aircraft Wireless Equipment.*
December 1.—A. Fage, A.R.C.Sc. *The Behaviour of Fluids in Turbulent Motion.*
December 8.—Lieut. J. S. A. Salt, R.E. *Air Survey.*
December 15.—Sqdn.-Ldr. R. S. Booth, A.F.C. *Airship Development Abroad.*
February 2.—A. Plesman. *The Operation of Aircraft over Tropical Routes.*
March 23.—H. M. Garner, M.A. *Seaplane Research.*

During the first half of the session Dr. Dornier will lecture on the lessons of the "DoX," and during the second half Wing Com. G. S. Marshall, O.B.E., will lecture on some aspect of the medical side of aviation.

Further lectures are being arranged and will be announced as dates are fixed.

Flying Restrictions—Aerobatics

AIR Ministry Orders of June 23, 1932, contain the following:—Aerobatics under 2,000 feet are prohibited. A.Os.C. may grant permission to carry out aerobatics under 2,000 feet in specific cases and for definite purposes. A minimum height will be laid in all cases where this permission is granted. The Director of Technical Development, Air Ministry, may grant special permission for aerobatics below 2,000 feet at experimental establishments for specific experiments.

Bertrand Stewart Prize Essay

THE subject for the Bertrand Stewart Prize Essay (for particulars see *Army Quarterly*) for 1933 is as follows:—

"British forces may be required to engage in warlike operations under a variety of conditions, both as regards the nature and armament of potential enemies and the climate and terrain in which operations may take place.

"Discuss these different conditions and consider how the lessons of recent campaigns can best be applied to present-day training methods."

PUBLICATIONS RECEIVED

Aeronautical Research Committee Reports and Memoranda. No. 1433. *Corrosion Fatigue Test on Aluminium Crystal.* By H. J. Gough and D. G. Sopwith. September, 1930. Price 2*s.* 6*d.* net. No. 1437. *Pitot-Static Tube Factor at Low Reynolds Numbers.* By E. Ower and F. C. Johansen. August, 1931. Price 1*s.* 6*d.* net. London: H.M. Stationery Office, W.C.2.

Down African Skyways. By B. Bennett. London: Hutchinson and Co., Ltd. Price 10*s.* 6*d.*

Steel Springs or Rubber Springs? The United Steel Companies, Ltd., and The English Steel Corporation, Ltd., 17, Westbourne Road, Sheffield.

COMPANY REGISTRATION

COMPER AIRCRAFT COMPANY, LTD. (Cheshire).—The nominal capital has been increased by the addition of £26,475 beyond the registered capital of £9,775. The additional capital is divided into 25,225 8 per cent. non-cumulative preference shares of £1 and 12,500 ordinary shares of 2s. each. (This increase follows a recent reduction.)

AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: Cyl. = cylinder; i.c. = internal combustion; m. = motors.

(The numbers in brackets are those under which the Specification will be printed and abridged, etc.)

Applied for in 1931

Published August 25, 1932

12,415 PIONEER INSTRUMENT CO., INC. Aeronautical navigation lamps. (377,710)
12,534 AKT. ATLAS DIESEL. I.c. engine air-compressor aggregates. (377,735)
13,041 H. J. TURNER and F. MATTISON. Flying machine. (377,774)
19,404 ECLIPSE AVIATION CORPN. Variable-pitch propeller. (377,797)
19,927 P. POOT. Screw-propellers. (377,804)
20,386 CIRRUS-HERMES ENGINEERING CO., LTD. and A. H. CAPLE. Inertia starters for i.c. engines. (377,810)
28,432 M. CHARLES. Hydraulic control of landing-brakes. (377,847)